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BY

FRANK B. MYRICK

Managing Editor, Bookbinding and Book Production



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FRANK B. MYRICK

Managing Editor, Bookbinding and Book Production

NEW YORK Bookbinding & Book Production

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Foreword

10/30/6

MANY a book is advertised as "the last word" on something or other. Author and publisher may be sincere and confident, but of course there can be no last word about anything.

Many more books, unsung but not unhonored, have printed and reprinted the letters and the few first words that are the beginning of all knowledge. A primer, like a sunrise, gives a little illumination in its brief moment and promises more light in the day of experience that is to follow.

This Production Primer contains the alphabet and some threeletter words in the vocabulary of bookmaking; the four-letter words associated with disaster and despair must be sought elsewhere; and the polysyllables of esthetic minutiae will eventually be borrowed from the other arts. Those elaborations may, in fact should, come later; just now we are concerned only with the practical mechanics of a complex profession.

Here are "the things that everybody knows" but that usually have to be learned the hard way; actually, they are not learned until they are experienced. A galley proof, no matter how clearly described, is an imaginary object until it is seen and handled; nor can its amazing properties be understood until one attempts to jog a hundred of them into a neat pile. The difference between single types and slug composition is unbelievable until a page of each—especially the former—is handled.

Here are the tools and materials that go into the making of a book. Every apprentice must shape them to his own dexterity or convenience. One will use word count for manuscripts and develop a habit of close approximation; another will count characters minutely—and sometimes make mistakes. One will be

FOREWORD

content to leave all technical details to artisans; another will be forever curious about how and why.

Yet alphabets and words of no-matter-how-many letters are isolated elements until they are assembled into a sentence; copy and proofs, type and ink and paper, cloth and binding stamps, are unrelated parts until they are integrated and become a book. No primer can, or should, attempt to teach that integration. Only imagination tempered by taste, ingenuity restrained by judgment, can determine the aspect and utility of a book.

With the ultimate purpose clearly visualized—a faculty which develops only with experience—each element and operation is fitted into its particular place in the pattern, just as the four strings of a violin are tuned to each other, and to the other instruments, before there can be music.

This foreword is equivalent to a binding stamp. It does not affect the contents of the book, but it may, if properly designed, indicate what the book is about. Yet it is only another way of doing what was done more clearly and directly in a note accompanying the first installment of this Production Primer, when it appeared in BOOKBINDING & BOOK PRODUCTION, March, 1943; where it was

"... dedicated to those unsung heroes and heroines of the publishing offices, the men and women who are given a 600-page manuscript, a publication date, and a lot of responsibility.

"In applying these articles, readers are reminded of the danger in a little learning unsupported by practical experience. Make it a point to visit printing and binding plants, and appreciate the intricacies involved in every step of book manufacture. For specific advice, ask the plants with which you deal."

Good Spelling!

WILL RANSOM

Acknowledgments

THE publishers and author of this book would indeed be remiss if they did not acknowledge their debt of gratitude for the assistance accorded them by many practicing experts in publishers' office, composing room, foundry, pressroom, and bindery. Whether at desk or machine, their patient advice and constructive criticism have been invaluable in shaping the text towards its announced goal of supplying an elementary guide to book production.

Our sincere gratitude is therefore extended to the following in particular: Bruce Gentry, The World Publishing Co.; Henry Cole, S. D. Warren Co.; James Gallo, American Book-Stratford Press; William J. Gartner, McGraw-Hill Book Co.; George T. Bailey, Photogravure & Color Co.; Lewis A. Ryan, Flower Steel Electrotype Co.; John Esak, Haddon Bindery; Theodore Tuck, Chas. H. Bohn Co.; Thomas Curry, H. Wolff Book Mfg. Co.; Eugene Rieder, Ralph Box, and William Johnson, Country Life Press; Fred True, E. C. Fuller Co; Theodore Clark, T. W. and C. B. Sheridan Co.; William Ader, Russell-Rutter Co., and Otto Paasch, Geo. McKibbin & Son. Many others helped in varying degrees, and to all, our many thanks.

A special debt is owed SS/ML3c William Nicoll, formerly of the U. S. Navy, and now back with Scott, Foresman & Co., for his urgent suggestion that B&BP launch a "kindergarten" series of articles on book production. Thanks to his persistence, the series was formulated and first appeared in serial form in B&BP.

In conclusion, a generous share of gratitude is reserved for those who carried on with the production of this book and

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FRANK B. MYRICK

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Estimating Copy

T HERE are two major methods of computing how big a book a given manuscript will make: word count and character count. The latter takes longer but is apt to be more accurate, chiefly because of the variation in authors' vocabularies.

Word Count

Count the words on 15 to 25 typical manuscript pages—10 is enough if the copy is fairly uniform—and multiply the average by the total number of pages. Short pages at the ends of chapters should be counted as full pages as there will be similar short pages in the type. (If ms. shows great variation in number of lines per page, average the number of words in 25-50 typical lines and multiply by the total number of lines in the ms.)

For most purposes a "full-line" word count should be made; i.e., short lines of dialog and last lines of paragraphs must be counted as full length, using the words in lines above or below to count by. This will eliminate much of the discrepancy created by heavy conversational copy.

Select the type face and point size in which you think the book should be set, and decide the width of line and number of lines you want in your page. Most type books contain specimen pages which tell you the number of words on each page. Dividing this figure, into the ms. wordage will give you the number of text pages the book will make in type, to which you add allowances for chapter sinkage and front and back matter. If you don't like the total, vary the page format until you get what you want. It's a matter of trial and error, but so—to some extent—is the more accurate method.

Character Count

The many exact copyfitting systems offered by type firms and typographers are much alike; the best rely on the known size of typewriter type. Ascertain the average length in inches of the typed lines of the ms. Elite typewriters give 12 characters to the inch; pica, 10. Multiplying the line length by the appropriate figure, 12 or 10, gives you the average number of characters to the line; multiplying this total by the number of lines in the ms. gives you the total number of characters in the ms.

Warning! Make sure that all pages of the ms. have been typed on the same machine and in the same average length of line; all differently typed sections, and those containing written or typed revisions, must be figured separately or your count will be thrown off. In counting characters, every space and punctuation mark must be included.

Again, to see how many pages the body of the book will occupy, total ms. characters are divided by the number of characters in the selected specimen type page. If the latter has been chosen from a book of specimen pages, it may indicate the correct character count. If not, multiply the number of lines in the type page by the number of characters in the type line.

Obtain this by averaging the characters in a few lines, or as follows: Refer to a specimen book which gives the length of the lower-case alphabet in the face you want to use, and apply the standard Linotype, Monotype, or Intertype tables. These give (a) the number of characters per running pica for various alphabet lengths, from which you derive (b) the number of characters in the selected measure (line length in picas).

If the book contains a great many chapters, each to start on a fresh page, you will need a still more accurate count: Figure each chapter separately and count fractions of type pages as full pages. Then, as in the word-count method, allow for prelims.

If your grand total of pages seems too great or too little, or

ESTIMATING COPY

does not work out to a number which can be evenly divided into 32p. forms, you will have to adjust the type page size, type size, measure, or leading, until it works out correctly. But don't neglect readability!

Examples

Given, a novel ms., pica type, 350 pages long. Average words to a line, 10. Average length of line, $5\frac{3}{4}$ ". Number of lines in the ms., 8,750. Selected type page, Caslon 11pt., leaded 2 points, 21x34 picas.

Word-count method: $8,750 \ge 10 = 87,500$ words in ms. Our copy-fitting chart or type specimen books shows 278 words per page in this size. 87,500 divided by 278 gives 315 pages of solid text. Allow 20pp. for prelims, chapter openings, etc. (Assuming the book has 16 chapters, there will be 8pp. for chapter sinkage and short endings, plus 12pp. for front matter.) Total, 335 pages, which makes ten 32p. forms plus one 16p. form.

You want to get rid of those 16pp.? Then let's work backwards. For a 320p. book, your solid text must not occupy more than 300pp. Divide the word count, 87,500, by 300, and the result, 292, gives you the minimum number of words you must get in the page. You find that either Garamond or Scotch in the same size, leading, and measure, yields 299 words, and hence requires 293 pages, plus 20, or a total of 313 pages—close enough to 320.

Character-count method: A $5\frac{3}{4}$ " line of pica typewritten matter contains $57\frac{1}{2}$ characters. The ms. therefore contains 8,750 x $57\frac{1}{2}$, or 503,125 characters. Your selected type page contains 1,565 characters. Division gives 322 pages of solid text, plus 20 for prelims, or a total of 342 pages. These would make just 10 pages short of eleven 32p. forms. Obviously you must enlarge the type-page size in order to reduce the book to 320 pages and have only ten. 32p. forms. To find out how, divide 503,125 characters by 300 pages—which shows that your type page must

contain at least 1,677 characters. If you keep to the Caslon, but increase the type page to 22×35 picas, you can get in the required number of characters, and your book will make up into just ten 32p. forms.

References

Don't expect to get it right every time—it's an exception when you do. There are too many variables to achieve perfection, but careful work will bring you reasonably close. Among the aids used in this article, and which you'll find invaluable, are: "A Simple and Easy Method of Copyfitting," found in the Linotype specimen book but available separately; "The Intertype Ready Reckoner"; the University of Chicago Press "Manual of Style"; and various book manufacturers' specimen books.

2.

Preparing Copy

N ^{ow} that you have estimated the size book your ms. will make, the next step is to mark it up for the composing room, making consistency in style, sense, and composition your constant guide.

If your office system requires it, read the manuscript carefully for style, otherwise, just glance through it to gain a general idea of its purpose and thought, to assist you in choosing its typographic treatment. In doing so, keep in mind the appearance of figures, caps, italics, and quotations in the type you have chosen, before definitely deciding upon it. You may generally assume that it needs no further revision for construction, sense, punctuation, and capitalization. If, however, there *are* numerous corrections, have it retyped (an excellent opportunity to have it done in the same number of characters per line as it will be set in type). For if more than 25% of the ms. has been so corrected,

the printer is entitled to charge extra for poor copy. Be sure to check carefully such details as chapter heads matching those in the table of contents.

General Style

Before going any further, prepare a general style and composition instruction sheet, setting forth clearly your specifications for text, heads, illustrations, captions and/or legends, folios, extracts, poetry, footnotes, and initials if any. Also indicate the number of galley, page, and foundry proofs you need, and whether the book is to be printed from type or plates, or by offset. If there is not already a customary office style, indicate a definite style to be followed, based on one of the standard dictionaries. Specify whether tight or loose spacing is to be used between words and sentences. Take care to mark the size and face of dashes. Some type families have short dashes which when run together for a long dash, form a broken one. Examine the copy carefully for illustrations (especially when they are to be inserted in the text), their size, sequence, and captions. Mark the locations with the approximate sizes, edit and mark the captions for setting and send the illustration copy to the engravers. Where feasible, when cuts are to be centered in the page with no copy on either side, have them blocked the full width of the type page to save make-up time.

Now it's time to get into the mechanics of preparing the copy itself.

Marking

Folio each sheet of copy separately, avoiding such worryraisers as 2a, 2a1, etc. Mark the last sheet as such, and assign Roman numerals to the front matter. If the copy is at all crowded, retype or paste it up on a larger sheet. As you proceed, remember that nothing should be left for the printer to wonder what to set it in. Be sure to make all corrections interlinear. In the event of editorial additions, have them typed and pasted in or the page retyped. Avoid editorial marginal notes.

Mark copy to be set in smaller sizes with a vertical line drawn alongside the left margin, one for each size smaller. Specify the size, leading and measure, if not fully explained in the style sheet accompanying the ms., in this order: 11/13 Caledonia, 21 picas. Mark hand type in blue pencil on the right. Be specific on indentions—the usual is one em. If the ms. has been typed with less than 5-space indention, mark each paragraph.

It pays to be thoroughly familiar with the entire font of the typeface you have chosen. When marking rules, stars, and other ornaments, make the number, size, and face as shown in your type specimen books, fully clear. Be extra careful with the numeration of footnotes, whether by chapter, page, or back-ofthe-book section.

Keep in mind that it is cheaper and easier to put the running head and folio on the same line, rather than on separate ones. If you use two or three-line initials at chapter beginnings, the first word or phrase should be set in caps or small caps to support it. Before definitely deciding on the face for chapter headings, test to see how it looks in both the longer and the shorter lines and if it will necessitate many double-lined headings. If so, their style should also be indicated and at what point they should break.

In general, if the ms. is typed with fair uniformity—like a novel ms., for example, with little change in size throughout only the first few pages need be marked for type. But be sure your instruction sheet contains full details for composition, so the printer won't have to call or write to find out what to do about thus-and-so.

Finally, if there are an appendix and index to come, note this fact on the last sheet of copy. Go back over the entire ms. to make sure that all markings are clear, especially those for killed matter—to avoid expensive resetting.

Estimating Tricks

In estimating the copy, here are a couple of tricks which may be used when you're pressed for time:

It may be assumed that the average number of characters per word is 6, so that multiplying the author's estimated wordage by this figure will give you an approximate character count.

Poetry can best be estimated by averaging the number of characters per line of the longer lines in each poem, and ascertaining in what measure it can best be set. From there on, you can figure the copy at almost line for line, allowing for the very longest lines, which may be set flush-and-hang. Determine the page size. If each poem can be run on a single page, you will automatically know the number of pages to your book.

References

Copy marking symbols are virtually alike throughout the country but if there are any variations practiced by your printer, he will be glad to point them out. However, almost any good graphic arts reference book, such as those following, will provide you with an acceptable set of marks. In preparing this chapter, these titles were consulted: University of Chicago Press', "A Manual of Style," Mentor Press' "Proofreading & Copy Preparation," Wiley's "The Manuscript," Crowell's "Complete Desk Book," J. J. Little & Ives' "Pertinent Points for Publishers," and Oxford University Press' "Manuscript and Proof."

And for Monotype copy fitting, there is the very complete "Monotype Copy-Type Calculator," as well as a supplement to the specimen book listing point sizes, set sizes, and alphabet lengths for all Monotype roman and italic faces. (The latter is available on request.)

There are many other guides and booklets that will prove helpful for their detailed instructions. If you have specific inquiries, ask your printer.

The Kinds of Paper

W^{HILE} computing your copy and preparing it for the printer, you should see to it that the proper paper has been chosen, ordered, and delivered. Much of the entire format of any book hangs upon the kind, finish, and weight of the paper chosen. If you have not already provided yourself with specimens of all kinds of "book" papers, you can obtain samples from dealers and manufacturers.

These are the 6 major types of book or text paper in common use:

Antique

The somewhat rough-finished, soft, absorbent stocks used for most trade books because they are suited to type and line subjects, reflect no glare in reading, and—since ink dries quickly on their surface—are well adapted to presses that print both sides of the sheet in one continuous operation. Often called *eggshell finish*, though generally eggshell is a little smoother and less bulky, and the surface does not show the narrow "hills and valleys," parallel with the grain, characteristic of antique finish. *Vellum finish* has a still finer grain than eggshell, is smoother, and is made from harder stock.

Laid refers to the faint ribbed watermark made by fine parallel wires on a roll through which some paper passes early in manufacture. Usually the roll is covered with a wire cloth that leaves no distinct mark and produces the standard appearance known as *wove*.

Bulking and high-bulk paper, produced to bulk more per given weight, are the softest of all book stocks. High-bulk is often difficult to print because of the loose fuzz that deposits on the plates and rollers on the press.

Antique and eggshell papers are not suited to halftone printing by letterpress.

English Finish

Book paper with a smooth and uniform surface and formation, but which has not subsequently passed through calendering rolls in its manufacture. In the same category is *machine finish*, which has a medium smooth surface—not as rough as eggshell but not as smooth as English finish. These grades are favored for schoolbooks or other books on which medium-screen halftones are to be printed along with type and linecuts. (Abbreviations are *E.f.* and *m.f.*)

Supercalendered

Also known as *super* or *s.s.s.c.* (sized and supercalendered). This is the smoothest of the uncoated book stocks, and is so called because the paper has been passed between the rolls of a supercalendar under pressure. When it has a very high gloss it is sometimes referred to as *plate finished*. Supers will print finer-screen halftones, and are popular for magazines.

Coated Papers

There are many varieties—chiefly process coated, glossy coated, dull coated, and coated-one-side—all of which take the finest-screen halftones. The first is a low-cost paper having a smaller amount of coating than the others and without their finish and surface. Glossy coated is the term applied to a base stock to which a clay coating has been added; it is used chiefly in catalogs and for insert plates. Dull coated acquires its characteristic finish through a combination of lighter calendering and the use of duller pigments. This greatly reduces the glare and makes type more readable.

Bible Papers

These thin, light-weight papers used chiefly for Bibles, dictionaries, etc., where strength, flexibility, permanence, opacity, and minimum bulking are criteria. Also known as *India paper* (not to be confused with India tint, which is a pale tan color).

Offset Papers

Being designed for offset lithography, they are processed to reduce stretching, shrinking, and curling. There are various finishes, both uncoated and coated. They will take fine halftones if printed by offset.

During normal times, of course, there is a wide choice of grades, sizes, and weights in which any of these papers can be purchased. Today the individual manufacturer of paper is restricted to specific sizes and weights, and sharply limited in his selection of colors and grades.

Normally, one may obtain virtually whatever is required if the quantity is great enough to justify a "making order." It is in such orders that the exercise of control over the formation of the stock may be had. When obtainable, various fillers such as titanium may be added to achieve greater opacity in thin paper.

There are many considerations to be weighed in making the final choice of paper, all of which can play a large part in the successful manufacture of the book. These will be dealt with in the following chapter, in which we will pursue further the completion of our hypothetical 320p. novel.

Consultation with paper merchants or manufacturers and with your printer and binder to find the paper which will satisfy all requirements will do much to simplify the choice of paper and guarantee results. For more detailed descriptions of the myriad kinds of paper there are many excellent sources, including "The Dictionary of Paper" (American Paper & Pulp Assn.) and "A Course in Bookmaking" (Employing Bookbinders of America).

Choosing and Ordering the Paper

4

To CHOOSE and order the paper for any book intelligently, the meaning and application of certain common paper terms must be known.

Paper is usually sold by the pound. The substance or basis weight of a book stock means the weight of 500 sheets of that paper in the basic 25 x 38 sheet size. Thus "50 lb. antique" means an antique stock of which 500 sheets in the 25 x 38 size would weigh 50 lbs. As the sheet sizes increase, the weight also rises in proportion; e.g., a ream of 50 lb. antique in 38 x 50 size would weigh 100 lbs., and it would be ordered as 38 x 50 —100. Of late there has been a tendency to use 1000 instead of 500 sheets as the basis. Consequently if you find a paper listed thus, 38 x 50—200M, you will know that it is still 50 lb. stock. Paper price lists contain tables that convert basis weights into ream weights. To find the number of pounds of paper you must order, you must first ascertain the number of sheets you will need, the sheet size, and then, from your paper supplier's catalog, figure their weight in the substance you have selected.

The page size should be selected with an eye not only to attractive proportions but also to using a standard size sheet with the least waste. However, when special considerations such as the size of illustrations warrant, "made to order" sheets should be used. The book paper sizes most commonly used in publishing are 38 x 50, 41 x 61, 44 x 66, and 46 x 69. There are tables which show quickly how many pages cut from a single sheet.

Our next task is to determine what sheet size our novel page will cut out from, the most economically, i.e., with the most number of pages and the least trim or waste left over.

Number of Pages to the Sheet

Suppose we have chosen a $5\frac{1}{2} \ge 8\frac{1}{2}$ page size. Adding $\frac{1}{8}$ " for trim on 3 sides brings it to $5\frac{5}{8} \ge 8\frac{3}{4}$. Dividing this into the various sheet sizes to see which will cut out the most economically, we find $35 \ge 45$ is the best size to use, as it will allow 32 pages to be printed each side, leaving no waste at all. ($45 \div 5\frac{5}{8} = 8$, and $35 \div 8\frac{3}{4} = 4$. Multiplying $8 \ge 4$ gives us 32.)

A 320-page book would be divided into ten 32p. forms, requiring 5 sheets for each book. If 5000 books are to be printed, 25,000 sheets are needed. Allowing 4% for spoilage, you add another 1000 sheets, making 26,000 in all. Your paper catalog will show that 1M sheets of 35 x 45 in substance 50 weigh 166 lbs. Multiplying this by 26, we find 4316 lbs. of paper are needed. (Under today's conditions it is safer to figure spoilage at from 6% to 8%—the longer the run the smaller the percentage.)

Now that we know how much paper to order, we must consider our choice. All the factors mentioned in the preceding article apply, as well as several others. Generally speaking, the major factors are bulk, grain, and finish, all of which affect the paper's printing and folding qualities. These are summarized for each finish in the following table (for offset printing, consult a lithographer).

Pros and Cons

Advantages

Disadvantages

Antique	Relatively inexpensive grades are available. Good for type, line, and Ben Day subjects.	Cannot be used for print- ing halftones, except by offset.
Lich Bull	Polosiuslu in our onsitus	Euro coucos pesso and

High Bulk.... Relatively inexpensive. Gives a book bulk or thickness. Fuzz causes press and folder trouble, with unpleasant effects on the appearance of the book.

CHOOSING AND ORDERING THE PAPER

E.F. or M.F	Suitable for 110-120 screen halftones.	Breaks down under re- peated folding, hence requires smaller forms.
Coated Stocks	O. K. for all halftones in letterpress. Good folding qualities in special folding grades.	Unless dull-coated, glare reduces readability. Expensive.

Our hypothetical novel is one which the editors believe will have a comparatively short life; naturally it has no halftones, and is not intended for textbook use. Consequently we may use an inexpensive antique-finish paper. In the case of an antique or eggshell, the only drawback is that in certain weights, such as the 50 lb. we have chosen, it is too heavy to fold well in large sections. Before switching to another stock, however, study this table of folding practice in book paper:

Recommended Maximum Pages per Section ANTIQUE: up to 60 lb., 32p.; 60-80, 16; over 80, 8. BULKING: up to 65 lb., 32s; over, 16s. E.F., M.F., SUPER: up to 60 lb., in 32s. COATED: never larger than 16s. BIBLE: up to 30 lb., in 64s.

Since the full sheet for our hypothetical novel would form a 64-page section, we must choose between having the book printed as twenty 16p. forms, and bound in 32s (16 pages on each side of the sheet), or asking the printer to arrange the 32 pages on each side (impose them) so as to permit them to be printed as two 16s, backed up with another two 16s, to be slit on press or folder into two 32p. signatures.

Definition of Terms

Bulk refers to the thickness of the folded and smashed signatures of any given book. There are numerous tables available which show the number of pages in various weights and finishes of book paper which will make a pile 1" deep. Printed on 50 lb. eggshell, which bulks around 460 pages to the inch, our 320p. novel will bulk about .7". If printed on E.f. of the same weight, it would be about .44" thick.

Grain refers to the direction in which the fibers of the paper run. Grain usually may be had in either direction, and should be specified so as to run parallel with the binding edge. In our $5\frac{1}{2}$ x $8\frac{1}{2}$ book the grain should be the short way of the sheet (i.e., in 35 x 45, the 35" way). Otherwise the folding would be done against the grain, with resultant irregular folding and cracking of the sheet, and unpleasing appearance of the page.

Flexibility is essential to good book paper. American readers react badly to stiff pages that have to be creased into submission.

Be sure that the paper you order is adapted to the presses and folders of the plants which do your work. Consult your printer if in doubt.

If there are only a few halftones to be used in the book, it is needless to use a halftone stock throughout. Have them printed on single pages to be tipped in, or in small signatures to be sewed or pasted in the book at proper intervals, or—most economical—print them all in one signature and bind them in at some appropriate point between sections or at the end of the book.

Having the sheets packed on skids instead of in cases will save you some money.

In normal times, virtually any size, color, weight, grade, or finish may be obtained on a making order (for minimum quantities ask your supplier). However, it is advisable to adhere to the standards whenever possible.

If you are planning to print by *offset*, keep in mind that while offset paper comes with various surfaces, including antique, it is specially manufactured for use in the offset process.

5.

How the Type Is Set

A LOT has been happening to your hypothetical novel ms. since—with a sigh of relief—you handed the typescript to the printer's messenger.

First, each of the 350 pages was carefully registered upon its arrival at the plant, so that a complete record might be kept of its progress from ms. to printed book. Then it was turned over to the superintendent of the composing room, the division in which the book is to be set in type. He examined it carefully to make sure that it was clearly marked so that the operators of the various composing machines and the hand compositors would have no difficulty in setting it. Then the ms. was distributed among the available operators.

The copy is usually divided up into "takes," or segments, of anywhere from 25 to 100 pp. each, for each operator or compositor to work on. It may even be divided, if the plant operates two or more shifts, so that each shift will have some, and thus the setting can be completed quickly. When all the copy is set, the various "takes" of type are assembled in sequence on long brass trays or "galleys" from which "galley proofs" about 18" long are taken for the author and publisher to read.

In general the composing room consists of a varying number of composing machines; a large group of type cabinets, in which are kept the hand types, ornaments, furniture, etc., needed to make up the pages and forms; and accessory equipment such as saws, miters, proof presses, etc. Above these cabinets are the sloped "banks" on which the type is made up into pages, and the "stones"—chiefly steel-surface tables—upon which the pages are made up into forms for the press.

All composing machines work on the general principle of the typecasting machines in type foundries. Solid lines of type or properly arranged lines of individual letters are cast in hot metal (mostly lead) from engraved brass matrices (mats), although the method varies with each machine.

Line Composing Machines

The line-composing machines, Linotype and Intertype, chiefly used for text and small display matter, function by means of a keyboard which permits the desired character-matrices to be released from a magazine, assembled in order, and automatically "justified" (spaced out to the desired measure). From the row of matrices the leaden line or "slug" of type is cast.

Most machines are equipped with from 1 to 8 magazines enabling the operator—at some loss of time—to shift from one face to another, or in some cases mix them in the same line. Each magazine contains all the mats comprising one size of one typeface. These magazines are of brass, and channeled to receive several dozen mats of each character which are released one at a time by light pressure on the keys.

After the slug is cast, it is trimmed to "type high" and ejected into a convenient tray or "stick," while the matrices and spacing material—"spacebands"—are returned to their proper places by an ingenious device. A long arm descends and picks up the matrices, thereby allowing the spacebands to return to their central point, while the mats are redistributed to their proper channels by means of teeth cut in their upper portion which enable them to be supported and propelled along a notched bar to the correct point.

It is one continuous series of operations, mostly automatic, although controlled by the operator at the keyboard.

As the operator can assemble and cast these lines with considerable rapidity—usually 3 lines are in the machine at one time, one being composed, the second cast, and the third dis-

HOW THE TYPE IS SET

tributed—at least one galley (about 4 pages) can be set in one hour on one machine.

Monotype and Ludlow

Monotype, as its name indicates, provides for the casting of one letter at a time. This is done by two machines, a keyboard and a caster. As the ms. is tapped out on the keyboard, a narrow paper roll is perforated much like that in a player piano. When the job is completed, these rolls are placed in position on the caster so as to actuate the motion of a small box of matrices by means of a blast of air through the perforations. This causes the proper letters to be presented in casting position in rapid succession. The cast letters are ejected into a galley in lines of the proper width at a speed comparable to that of the Linotype.

Since the ms. might contain lines to be set in a face larger than any available on our printer's machines, or in a face which he does not have, these may have to be hand-set or produced on another type of line-composing machine. This may either be the Ludlow Typograph or All-Purpose Linotype. These amount to line-composing machines in which the matrices are selected, assembled, and spaced by hand. Eeach line of mats is locked in the machine and mechanically cast. As with hand type, the mats are then distributed back to their cases for future use.

Hand Composition

If the shop should not be so equipped or the desired type face not be available on the machine, these lines might be set by hand either in the same shop or by a commercial typographer by hand or by machine. Individual letters, spaces, etc., known as "foundry type" are cast on special typecasting machines by type-founders. They are purchased by the composing room in sets or "fonts," and stored in the type cabinets mentioned above—designed for rapid assembly and distribution of lines to be set in those faces.

"Quads" and other spaces are kept below type-high so as not to print.

Practically all type, whether machine- or hand-set, comes in series or sizes of the same family. In addition, all machine composition may be set so as to provide for various "leading" or spacing between the lines. By an adjustment on each machine the type may be cast on a body that is the desired point size with the additional space on the lower part of the slug or letter. The purpose is to save considerable time in spacing the many lines in the book.

If additional spacing is needed, such as in a juvenile, individual lead spaces of various sizes may be inserted. These are made chiefly in 5 thicknesses, 1, 2, and 3pt. "leads" and 6 and 12pt. "slugs." Naturally they, too, like the quads and spaces, are lower than type-high so that they will not print. In addition, there are wood "reglets" of 6 and 12pt. thicknesses which can be used for the same purpose.

Leads and slugs may be cast in strip form on machines such as the Elrod or All-Purpose Linotype, and cut to the desired measure.

The ms. may also call for the use of rules, dashes, ornaments, most of which are cast on the various machines mentioned from what are known as border slides inserted in the casting mechanism. Rules may be either thin brass strips or cast in lead similar to leads and slugs. They have various faces on different body thicknesses, such as 1pt. on 2. Dashes and ornaments may be individual types of various sizes, but are frequently cast from special mats.

Handling the Proofs

W HILE the ms. is being converted into type, the wise production head will be busy cleaning up such important details of the finished book as completing the jacket and binding design and ordering the cloth and stamping dies.

Meanwhile our hypothetical novel has arrived at the proof stage, when (theoretically, at least) every editorial or typographical error comes to light. There will be a galley proof, a page proof, and occasionally a stone proof, providing the printer's proofreaders, the publisher, and the author with the opportunity to produce an error-free book.

While most book printers provide their own proofreading service, there never can be too many readings of a proof, especially of a scientific work. Consequently most publishers perform a reading of their own. The publisher is entitled to clear, black proofs on fairly good paper, so that there will be no question of what are errors and what are not. Letters which are faint on the proof may or may not be broken letters, for example. (Mark them to be sure.)

Galley Proofs

The first set of galley proofs is usually in triplicate—two for the office, including the "reader's," and one for the author. The latter is for his reading, corrections, and indication of the location of any illustrations; the extra set for reference or occasionally, dummying. Usually an earlier set is read at the printer's and the major corrections are made before pulling a set for the author. Never allow the "reader's" to leave the office.

The first galley reading at the publisher's office should be a

silent one for typographical errors; the second an oral reading made with a copy holder to check faithfulness to the original. Any important changes from the author's copy, or questions on sense, dates, etc., should be ringed and marked with a fully explained "query" to the author; these must be settled before the final proof can be okayed. (In many large publishing offices, all matters dealing with the reading and correction of proofs are in the province of the editorial and not the production department.)

Two major points to be remembered in using proofreaders' marks, are legibility and neatness. Every mark must make the meaning of the indicated change completely clear, and they should not be crowded together. Either fine pen or sharp black pencil may be used, depending on the proof paper. The marks in general indicate errors in punctuation, typography, spelling, and sense, besides special notations for insertion of footnotes, references, etc. Each mark should be placed on a line with that in which the correction is to be made. When there is more than one to a line, diagonal lines to separate them should be used. Guide lines drawn to other parts of the proof should be avoided except in narrow margins or on extremely "dirty" proofs (those with many errors), and then should never cross each other.

Any corrections made on the author's proof are added to the reader's as soon as his are received, and this single comprehensive set of proofs is returned to the printer. Sometimes clean galley proofs (i.e., with all corrections set in type and inserted) are made up and submitted to the publisher for final check before pages are dummied. In order to check earlier estimates, to confirm the amount of paper to be ordered, and to permit early manipulations in the length of chapters and of the entire mss., some publishers request the printer to furnish a preliminary page count along with the first galley proofs.

By this time the final instructions should have been issued for style of chapter titles, amount of sinkage, running heads, illus-

tration captions, front and back matter (the title page, copyright notice, preface, appendices, etc.) so that the printer may proceed with making up the pages. Suggestions for sequence of front and back matter will be found in the various references mentioned earlier.

Page Proofs

The next step is the submission of page proofs, a set each for author and publisher. This is the most important set of proofs of all, for it is here that "author's alterations" or A.A.s may start piling up. Omissions or "outs," if not properly handled, may mean the remaking of several pages. The author should be impressed with the importance of compensating for the addition of new matter by trimming away an equal amount of copy, so as to avoid remaking entire chapters. It is from page proofs that the index, if any, is compiled; but otherwise, these busy days, publishers frequently dispense with sending page proofs to authors, their galley corrections being final.

As Robson warns in "The Complete Desk Book" (Crowell), there are at least a dozen important things to be considered in page reading, as follows: proper page sequence, correct placement of running heads, pages of the correct length, all galley corrections checked, transposition of lines and continuity from page to page watched carefully (often even the omission of an entire line does not at first seem to change the sense of a sentence), drop-outs (characters that do not show up on the printed page clearly or at all) and doublets (duplication of words often made when resetting a corrected line). Also, the ends of lines may become damaged so that they may punch through the paper, not show up clearly, or be out of alignment. The same may be true of individual characters throughout the text. Finally, the position and correctness of all illustrations, if any, must be checked with the illustration dummy, the position of all footnotes verified, and any queries disposed of.

In addition, this is the time in which to juggle "widows" short lines at the top of the page—or "rivers," very apparent channels of spacing in several adjoining lines. The latter can often be adjusted by the printer if they are marked on the proof. If the widow cannot be eliminated by resetting a few lines, the margins may permit you to shorten or lengthen, by one line, both pages of the spread on which (or near which) the widow occurs. Keep in mind that revisions are costly, and should not be made unless important. Folios are now filled in on the Table of Contents and List of Illustrations.

Final Proofs

If the book is to be printed from type, there will sometimes be a final proof, the "stone proof" of each form. Rarely press proofs are given. If the book is to be printed from electrotypes, a "foundry proof," with all the pages locked up for molding, will be supplied. Since these are the last proofs to be seen before the completed book is delivered, any broken letters or indistinct lines of type and other errors, must be marked and corrected now or they will appear in the final book.

If the text is to be printed by offset or gravure, every effort must be made to insure clean proofs before reproduction proofs are pulled, since errors discovered after the plates are made (as with electrotypes) may be corrected only at considerable expense. In making any major correction, the cost of the change should be weighed against the seriousness of the error. There *have* been occasions in which an error was so serious that an edition was cut apart, a corrected signature inserted, and the book rebound; but fortunately such instances are extremely rare.

In some larger offices, methods of handling proofs vary somewhat from the above. Stone proofs are never provided and frequently the author sees his book in page form only, before completed copies. The Editorial Dept. decides how many sets of proofs are needed, and the Manufacturing Dept. has only to
CLOTH, BOARD, AND END PAPERS

secure that many and then see that editors' and author's corrections on each of the required sets are consolidated in a final master "revise proof." Seldom does the author see the first galleys of his book until the worst of the actual typographical errors are cleaned up. Such things as "rivers," however, while marked, are not corrected until the book has been made up in pages, since they are frequently broken up in the process.

Cloth, Board, and End Papers

7.

THE successful production of a book calls for some dexterity on the part of the manufacturing executive, who, like a circus ringmaster, must keep several activities going at a time. In the midst of proofs, he—or she—must be seeing to it that the cloth has been selected, ordered, and delivered, the binding dies made, the boards ordered by the bindery, and the jackets prepared. Unless this is done, the production department may find itself in the embarrassing spot of being ready to bind but unable to because the cases are unfinished.

The Cloth

In normal times, ordering cloth was a matter which required a minimum of forethought. One merely selected a color, texture, and price range which fitted the manufacturing program, found out from the binder how much material was needed, and had him order it. Except on "making" orders, delivery was usually effected in a few days, ample time to meet the folded sheets at the bindery. For many months, now, shortages of grey goods, dyes, and labor have made it necessary to place the order for cloth just about the time the ms. lands on the production desk, and in some cases sooner.

Binding designs for some time have been based far more upon qualities and colors available than on esthetic considerations. Neutral combinations which can stand a change in the color of the cloth without loss are advisable under these circumstances. Yet there is still a sizable choice of designs and shades, all of which are found under specific grades and types of cloth.

The general term "bookcloth" covers two main divisions of material. In one, the cotton grey goods is dyed and treated with either a starch filler material ("starch-filled") or left in the natural rough state ("natural finish"). In the other, the material is either impregnated or coated with pyroxylin, a plastic, which creates a waterproof, extremely wear-resistant cloth. These pyroxylin-coated cloths are also known as "artificial leathers." Other plastic based and coated cloths are being developed also.

Starch-filled cloths are customarily supplied in vellum and linen finishes. "Vellum" describes a smooth coating of starch which covers the threads more completely than in the linen finish. "Patterns" are seldom available in the latter because its rougher surface does not take them well. "Linen finish" refers merely to appearance, not construction, as no linen is used; however, some manufacturers offer special cloths containing real linen.

Some years ago, all bookcloths except natural finish were officially grouped into an alphabetical progression of A-F to classify them by weights. These are subdivided in a price structure based upon "qualities" or trade brands. Groups A, B, C, and C-1 cover the light, medium and heavy cloths used customarily for trade and some textbooks; D, E, and F are the corresponding grades in the buckram group, strong cloths in which one set of yarns is woven double for extra strength and wearing qualities. They are used chiefly for library and textbooks.

Cloth is priced by the yard and sold in rolls, usually in 36" and 38" widths, and averaging 40 to 60 yards a roll.

CLOTH, BOARD, AND END PAPERS

Most cloths have been available with the surface embossed in many different patterns, some similar to familiar leather grains, others to various types of paper. The designations of these patterns are, for the most part, standard among all manufacturers, and the sample books contain complete showings of these patterns, as well as colors and finishes.

The best practice in ordering cloth is to notify your binder of the number of copies, size, and bulk of the book, the style of cloth you have selected, and ask him to estimate the yardage required. His experience and knowledge of his own equipment best qualifies him to make that computation. He can tell you, to, if the cloth is suitable for the desired stamping or printing.

If you like arithmetic, here's a way to make a very rough estimate of the yardage required: First ascertain the size of the boards. To find their *height* (i.e., the long dimension), add the trim-size height of the page to the width of the squares. (These are the narrow margins inside the cover, which show at the head, sides, and foot of the finished book. They vary from 1/16 to $\frac{1}{8}$ " wide, depending on the bulk.) The *width* of the boards is usually $\frac{1}{8}$ " to $\frac{1}{4}$ " less than the trim-size width of the page, plus the allowance for the square. Thus if the trim size is 5 7/16" x $\frac{81}{8}$ " (x 1" bulk), the size of the boards would be $5\frac{1}{4}$ " x $\frac{81}{4}$ ". Now that you have the board size, you can estimate the cloth in this way:

To the *height* of the board add $1\frac{1}{4}$ " for the turn-ins (the edges of the cloth which are folded over to the inside of the covers) to find the length of the cloth for one cover. To find the *width* of the piece required, double the board width, add $1\frac{1}{2}$ times the bulk, plus $\frac{1}{2}$ " for joints (the grooves in the cover where the boards stop and the backbone of the book begins) and $1\frac{1}{4}$ " for turn-ins. Thus, $5\frac{1}{4}$ " doubled = $10\frac{1}{2}$ ", plus $1\frac{1}{2}$ " for bulk, plus $\frac{1}{2}$ " for joints and $1\frac{1}{4}$ " for turn-ins = $13\frac{3}{4}$ " and $8\frac{1}{4}$ " plus $1\frac{1}{4}$ " = $9\frac{1}{2}$ ". This gives you the size of the piece of cloth required for one cover: $13\frac{3}{4}$ " x $9\frac{1}{2}$ ". The roll width into

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which $9\frac{1}{2}$ " divides with the least waste is 38". Dividing a yard's length of this (38" x 36") by one cover ($13\frac{3}{4}$ " x $9\frac{1}{2}$ "), you find that you will get 10.48 covers from a yard. If you have 5000 books to cover, you will need approximately 477 yards plus about 5% for spoilage, or roughly 500 yards. But for actual requirements, be sure to have your binder figure it accurately—it will save you cloth and trouble.

Boards and End Leaves

Ordering the boards is likewise best left to the binder, who will choose from three types, depending upon the price of the book and its intended use. Binders board is a solid heavy board made in one thickness in one operation, while chipboard is a less costly board made from chips and waste trimmings. Pasted board, as its name implies, is built up from several layers and is frequently used for low-cost books. If flexible covers are desired, there are both flexible and semi-flexible boards. The binder is competent to choose the type and thickness as well as to order the right quantity. From the full-size sheets, his board-cutting machines rapidly produce the necessary front and back cover and backbone boards.

The connecting links between book and cover are the end leaves, the four or eight pages at the front and back of the book, one leaf of each being pasted flat on the cover, and the whole joined to the book proper by "tipping" along the binding edge. End-leaf stock, manufactured for the purpose, is much stronger and more flexible than the text stock; it is customarily supplied by the binder. It should either be the same tint as the paper in which the book is printed, or harmonize with the cloth, edge stain, or other element of design. If you want to print an over-all design, a map, etc., on the end papers, check with printer and binder to make sure of selecting paper suitable for both printing and binding.

Specifications

Books are so frequently manufactured completely in one plant, that a joint specifications list for composing room, pressroom, and bindery will suffice. In any event, a complete record should be kept of the data which these important adjuncts of book production require, for the sake of eliminating any misunderstandings or production failures due to lack of information.

Instructions to be given the composing room already have been touched upon in our chapter on preparing the copy. But both bindery and pressroom need to know some of the specifications supplied the composing room, such as the number of pages, type, weight, size, and source of paper, trim size, how many pages to a form and the number of forms, and any color instructions or illustration specification. The "jacket" or production envelope should also state whether the job is to be printed from type or plates, and who is providing them.

Because the bindery has so many more operations to perform, it must be supplied many more details, of which the following list is typical: the number of copies to be bound from the printed sheets, and the place where they are to be obtained; the final trim size, and from which edges (top, fore, or bottom) the trim is to be taken; or if untrimmed, what edges are to be left rough; what color stain, if any, or if the book is to be gilded, and on what edges; the bulk of the finished book; what type of sewing; location and method of binding inserts, illustrations, etc.; details on boards and endpapers, if supplied from other than bindery stock; whether the book is to be bound with a tight, hollow, round or square back. (In tight backs the binding edges are securely glued to the backbone; in hollow backs they are not. Square-back books are usually tight-back style, and the binding edges of the signatures are not rounded out as are those of the round-back type.) Also what lining (the strips of cloth and/or paper glued to the backbone to reinforce the sewing) and if headbands are desired.

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In addition, the binder must know the make and source of the cloth, unless he himself has already placed the order; the type of cover decoration, whether stamping, printing, embossing, and the sources of the dies, type, or plates. Finally, he must be apprised of the source of supply for the jackets, how many copies are to be wrapped, stamped, and delivered, and he must also know what to do with the balance of the printed sheets or bound copies.

The best practice calls for maintenance of a complete production record of the job, from the moment the ms. is received, to the delivery of the finished book. Space should be provided for checking the production department's own rough estimates of cost with more exact figures and final bills from the printer and binder. In addition, for the sake of an accurate chart of the various stages of manufacture, record should be kept of the ordering of paper, plates, type, etc., so that delivery dates for each can be checked at a glance and an idea gained of how things are going.

8.

Covers and the Jacket

A FTER the covers, or cases, have been completed—generally on an automatic casemaker which combines cloth, boards, and glue into the finished cases—they may be stamped in ink or leaf (foil). Besides genuine gold leaf, there are various qualities of imitation gold, some affording greater permanency than others. Increasingly popular is pigment leaf, which comes in white and many opaque colors and gives a more solid impression than ink.

If the cover is to contain any hand lettering or other art work, a drawing is made in correct proportion, the die-maker photo-

COVERS AND THE JACKET

graphs it and prints the negative on a smooth sheet of sensitized brass, $\frac{1}{4}$ " thick. The plate is then etched, much as in regular photo-engraving, and routed deeply so as to prevent filling up of minute details in the stamping. (It's better to avoid these in the design to save trouble all around.) Lettering and all fine lines are carefully etched to avoid ragged edges or nicks.

If two or more colors are involved, the design is usually painted upon a cloth sample to study the effect; separate drawings are then made for each color, taking care that each die will register properly.

The design may also involve the use of type, which may be stamped from specially prepared binders' dies or from handset brass type; but if the runs are very short, special electros or even machine-set lead type may be used, though with less satisfactory results.

The type matter in the cover design must be set to the desired proportion. If dies are to be used, these will be made, either actual size or in reduction, from clean, sharp press proofs supplied by the compositors. If the type is to form part of the design, the proofs may be pasted in the proper position and a single die made from the completed piece of art work.

Fine lines and thin types can be successfully used only if the design would not be harmed by the slight spreading to which stamped lines are subject. Remember also that fine lines will generally be obliterated on rough-surface cloths. Bold types and strong lines should be used for these and for cloths in which the pattern is very pronounced. Remember too, that the combination of narrow lines and solids in the same die may cause trouble in leaf-stamping, for the degree of heat required to secure adhesion of the solids is often too much for the thinner portions, which may flake off.

Great caution should be observed in planning color combinations. For instance, a light color stamped on a dark cloth requires either two or more "hits" (impressions) of ink, or the use of

colored leaf. Before ordering the dies, check with the engraver and the binder on the practicability of the combination. These days neutral combinations are advisable.

Pre-Printed Covers

As an alternative, or supplement to stamping, the cloth covers may be pre-printed—before the cases are made—by letterpress, offset, or silk screen. The offset process is particularly adaptable to over-all designs, which may be printed either on single sheets or on a roll of cloth, after which the cloth is cut apart into individual covers, and sent to the bindery. Here it is made into cases, on which in turn the title may be stamped if not already included in the offset design. White or light tints of natural-finish or rough grain cloths are best for this work—they will successfully take fine screen halftones (133) as well as line work. (Smooth finish cloth must be varnished after printing to hold the design.) Bleed designs have a tendency to flake off the edges and joints.

Silk screen is particularly adapted to runs of under 5000 and to jobs on which large expensive dies would otherwise be required, or when big splashes of color are wanted. The copy is prepared actual size, from which the screenmaker prepares his stencil. The colors are applied in the form of special paints.

In planning the cover, make certain of the over-all width of the spine, and the amount of round (if the book is to have a rounded back). Otherwise the design may be too skimpy for the backbone or, if the round is extreme, the parts of the design near the joints may not enjoy full visibility.

Planning the Jacket

One of the most important jobs of the production department is the design and printing of the book jacket. Since the jacket is considered one of the major sales points of the trade book, it has grown more and more attractive with the years and the art work has correspondingly become elaborate.

Determining the size of the jacket means calculating the overall size of the book, in somewhat the same fashion as for ordering the cloth, but still more fractions must be added. To avoid an overdose of mathematics, it might be wise to adopt the standard jacket layout sheet, such as the one in use by several publishers. This is a comprehensive chart showing the layout of the jacket with space for indicating the dimensions of the back flap, back ad, backbone, front, and front flap. At the proper points indication is made of the amount to be added for the rounds, folds, and bleeds (if any). Usually $\frac{1}{8}$ " to $\frac{1}{4}$ " suffices for the round, $\frac{1}{4}$ " for the folds, and $\frac{1}{8}$ " for bleed to each dimension on which the art work is to bleed. The average width of the flaps is from $\frac{31}{4}$ " to $\frac{41}{4}$ ", depending upon how the desired size jacket will cut out of the sheets. Several dollars can often be saved on paper by using a narrower flap.

The corners of the flaps are ordinarily trimmed off at varying angles. It is done frequently in cases where the publisher is not sure of the final price of the book, and sets two or more prices in the corners, so that judicious trimming can remove the unwanted price. The chief purpose of such trimming, however, is so that the corners will not catch and tear when the book is handled, as jackets have a tendency to work up beyond the edge of the book.

In "balmier days," publishers were able to use coated-twosides paper for jackets, as well as offsets and antiques. However, coated-one-side is proving quite satisfactory. Either this or an offset paper may be used for ordinary or halftone process work in either letterpress or offset printing. A heavy antique with a sturdy surface is recommended for heavy line drawings, so as to eliminate flatness, while a smooth surface antique is best for large areas of solid color or fine lines. The grain usually runs the short way of the jacket (the height of the book) so as to allow it to hug the book.

Because of labor shortages in the engravers' shops today, they welcome the person who sends them the easiest and most com-

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plete art work for jacket plates. For example, it is advisable to have the title of the book and name of the author drawn in the art work, unless it is a purely typographical jacket, to save time in making additional hand corrections in the color plates. One trick to avoid an extra color plate is to use a colored stock, with, say, three printed colors. The art work is usually prepared for either one-third or one-half reduction.

Jackets printed on smooth paper are usually varnished to give snap and at the same time protect the ink areas from scratching. However, because of the limited supplies of raw materials for this process, many jackets are now being run in gloss inks or without any special treatment.

9.

The Illustrations

THE PRODUCTION department has still another important job —that of planning, preparing the copy, and ordering engravings for the illustrations.

The Copy

Illustration copy is usually submitted in the form of rough pencil or pen and ink sketches and photographs, which may be finished in any form suitable to the type face and kind of paper that have been planned for the book. On many occasions the type of copy may determine the choice of type and paper.

In planning line illustrations it is important to take into consideration the face of type in which the book is to be set. The artist selected to prepare the reproduction drawings should be acquainted with the type face and cautioned to prepare the drawings to conform with it in tone. This will avoid having heavy or dark illustrations for use with a light type face and vice versa. Drawings for reproduction are prepared twice size for onehalf reproduction. Drawings should *not* be prepared for samesize reproduction. The purpose of preparing larger size drawings for reduction, is that small imperfections inherent in all drawings even when they are prepared by the most competent artists, will be eliminated or at least minimized in reduction in the process of engraving. In same-size reproduction, imperfections in drawings have a tendency to become magnified. Sometimes, because of their size, drawings are prepared for only one-third reduction. At other times, when illustrations contain a considerable amount of detail, the artist may find it desirable to prepare the drawings for a greater reduction, either two-thirds or threequarters off.

When lettering is used in illustrations the artist should be cautioned to pay particular attention to its size, varying it for the different reductions so that when reduced, the lettering in all illustrations will be uniform in size.

When a book contains a large number of illustrations, it is good practice to instruct the artist to prepare as many drawings as possible for the same amount of reduction. The purpose is to take advantage of the engraver's 'same-focus'' rate, an economy measure.

Before copy is turned over to an artist it should be carefully marked with the final reproduction size. If this detail is to be left to the artist's judgment he should be given the dimensions of the type page and instructed to confine within these dimensions the sizes of the reduced illustrations.

Halftone copy is generally submitted in the form of glossy photographs which are suitable for reproduction with little, if any, special preparation. Sometimes there are blemishes on photographs. These usually can be easily eliminated by retouching. Sometimes details are not clearly defined, blending into the background of the general picture. This again can be corrected by judicious retouching. When colored photographs are sub-

mitted for black and white reproduction the colored prints can be converted into black and white through re-photographing. An orthochromatic negative is made, from which a black and white print is prepared.

Photographs are not always reproduced in their entirety. Sometimes it is desirable to eliminate unnecessary portions. At other times it may be considered desirable to change the shape or proportions of a picture. This is accomplished through the medium of cropping; indicating on the photograph for the engraver's guidance how much of the picture he is to reproduce. Crop marks are best indicated on a picture by short lines and dimension arrows made on the outside edges of the print with a "Litho" or grease pencil. A grease pencil is used because it will not mar the photographs and the markings can later be removed simply by rubbing them off the print with a clean cloth.

Although most book budgets will not permit the use of illustrations in color they can be used sometimes. It is assumed that, if the reproduction copy is not submitted, a competent artist will be employed to prepare it. It should be borne in mind that reproductions in color are best reproduced from single full-color prints with the color separation made by the engraver. It is not advisable to have separate color drawings prepared for subjects that are to be reproduced in register. Usually artists cannot prepare separate color drawings accurately enough so that they will register properly in reproduction.

Marking the Copy

In preparation for ordering engravings all copy should be marked with the reproduction size, and any special instructions to the engraver carefully indicated. Instructions to the engraver should be marked on the face of the copy whenever possible. If there is no room on the face, the reverse side may be used. Certain types of instructions are best indicated on a tissue laid over the face of the subject.

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In ordering halftones the screen to be used should be specified. This is determined entirely by the kind of paper on which they are to be printed. Halftones for use in books are made usually in 120, 133, or 150 line screen. The 120 line screen is suitable for printing on supercalendered paper; 133 line screen for printing on ordinary coated paper, and 150 line screen for printing on better grade coated papers.

It is always advisable to have proofs of engravings prepared on the kind of paper that will be used for the book. This will avoid disappointment with results later.

In preparing to submit illustration proofs to the author, when this is required, it is desirable to mount them on sheets of uniform size for convenience in handling. This will be not only a convenience but will also serve as a safeguard against the danger of loss of small pieces of proof.

Line-Engraving

To transmit a finished drawing, photograph, painting or block print to paper, a line or halftone photo-engraving depending on the type of copy, is required. For the present, we will consider only the simple form of line work. For a linecut—used if the subject is purely black and white or well defined solid colors, and has no graduated tones or shades—the copy is mounted in front of a special engraver's camera and photographed. The negative consists of a glass plate coated with a light-sensitive solution. The camera is adjusted so as to reduce or enlarge the copy according to instructions. The finished negative resembles those made when using your own camera. The white portions in the copy are black in the negative and the black portions, white.

The linecut or line etching process is suitable for the reproduction of most pen and ink or crayon drawings on smooth or rough paper, or for prints from original handcut blocks.

It is possible, however, to achieve something of the effect of the tonal areas of a halftone by use of the Ben Day process,

either employing specially prepared shading sheets or the standard Ben Day screens used by most engravers. The process is not in common use for books, but has possibilities in saving the cost of process plates for inexpensive juveniles. The sheets are of cellophane with all-over designs or shading, and from them are cut the outlines of the areas in which the design is wanted. These are placed on the copy with a colorless adhesive, and thus photographed as part of the copy.

The standard Ben Day screens are applied after the negative has been made, by a combination of a special gelatine screen and transfer ink. The production department ordinarily indicates the number or type of screen on an overlay on the copy and marks with blue-pencil the portion of the copy in which it is desired, since the blue does not photograph. The negatives then follow the same procedure as an ordinary line subject.

In addition, there are types of drawing paper, so treated as to cause a screen or stipple finish to appear in those parts brushed with liquid after the outline drawing has been completed.

The exposed glass plate is coated with a solution of collodion and rubber cement so as to give the negative body and toughness for the job of "stripping" and "flopping" the negative. This step is necessary so that on the finished plate the image will be in reverse, for printing like the original. Otherwise the printed version would be the exact opposite. Thus by not having the negative flopped it is possible to reverse the way in which an illustration faces.

It is in this process that various combinations of illustrations may be made, one or more imposed on others, to secure montage effects, or line and halftone work combined. All such extra work is costly in both money and time. At this point too, the Ben Day is applied, if wanted.

The negative is next placed against a sheet of sensitized metal in a vacuum printing frame and exposed to a strong light, which penetrates the transparent parts of the negative (the original

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lines of the copy) and hardens the surface underneath. The dark parts of the negative protect the remainder.

The plate is then "rolled up" with etching ink, and carefully washed. In the process the greasy ink protects the hardened lines but the balance of the sensitizing solution washes away. The result is a fully developed image of the original on the polished surface of the metal, from which the finished plate will be made. (For line engravings, the metal is almost invariably zinc.)

If the plate were printed now, all that would show would be a solid black impression, for the lines of the image are not in relief on the plate, which must be etched so that these lines will stand out. In order to protect the sides of the lines from being undercut, the plate is dusted with an acid-resistant powder ("dragon's blood"). The plate is heated to melt the powder into a protecting coating, and then etched with nitric acid. Several "bites," as this operation is called, are given until it has been etched deeply enough. Any remaining "dead metal"—metal which is not yet so low that the paper would not receive an impression from it in printing—is then routed out by whirling a high-speed bit over it. The plate is carefully examined for defects, then mounted on wood.

Under the classification of line subject reproduction may well be included those methods in which the printing "plates" are prepared by the artist, such as wood blocks, linoleum blocks, copper and steel etching, handcut stencils for multicolor illustrations, direct drawings on litho stones, aquatint, rubber plates printed in combination with a zinc key plate, either in regular oil-base or watercolor inks (the Jean Berté process). Another method is to have the artist draw directly (in reverse position) on grained celluloid which is placed over the zinc plate and a linecut made for letterpress work, or used as copy for an offset plate.

Halftones

The halftone calls for a somewhat different procedure in the transmission of original tonal copy to the printed sheet. Because

such copy contains tones of color or shading, these must be translated into solids of varying density and white areas to afford a printing surface which will convey such tones. For this reason, a screen composed of cross lines ruled on glass is introduced between the copy and the plate when the negative is made. The effect is to break the subject up into large and small dots since, in the exposure of the negative, the light has been permitted to pass through between the lines of the screen only. White areas in the copy, because they permit more light to pass through, cause only very fine dots to be formed while dark areas result in clusters of heavy dots. The negative is then printed on zinc or copper, depending upon the cost and use of the finished plate (copper is ordinarily used for fine work on good quality paper). The result is a printing surface of raised dots of varying intensity, from which the image is printed. The etching acid eats away the metal between the dots, and in the print, the tonal effects appear as they were in the original.

By increasing the screen, i.e., increasing the number of lines to the inch—and by the same token, the number of dots—much finer halftones can be produced for use on coated or supercalendered papers. It is wise to submit to the engraver a sample of the paper on which the illustration will be printed and let him specify the screen, if there is any doubt.

A much more complicated procedure is necessary in the production of process color plates from color copy. The first step is to break the copy down into black and the three elementary colors; yellow, blue, and red. The copy is photographed through appropriate filters which shut out all other colors except the one desired, and thus four separate negatives are made. A screen of the proper density—usually 120-line—is used. Each of these negatives is printed on metal in the same way, and the finished plates, when printed in proper rotation, produce a complete facsimile of the colored original.

In photographing the copy, the screen is purposely shifted

slightly for each plate, so that the finished plates do not register directly on top of each other. The reason for this is that the slight variation in register creates still another optical illusion, that of seeing the complete original colored picture. Color plates, when examined under a glass, will readily show the existence and pattern of these dots.

10.

Offset, and Gravure Plates

THE methods of reproducing text and illustrations described heretofore have concerned only letterpress printing. Producing offset or gravure plates involves a somewhat different procedure. In neither case, is the text printed directly from type. On the contrary, the printing surface for each is a complete plate including both text and illustrations, achieved by combining negatives of both. Size of the plate may include up to 64 pages.

The Offset Method

For offset reproduction, clean, sharp proofs of the type, usually on cellophane or glassine, are first pulled and then photographed; the glassine proofs are sometimes used as copy and may be intensified by proving on both sides. Frequently such proofs and the line copy are combined on a board the exact size of the press sheet and photographed directly on the zinc printing plate. However, if there is tone copy, this is photographed through a fine screen onto a glass or film negative, and from the latter, a positive is made for mounting with the other copy (paper negatives are also used). Or negatives of both are combined on an underlighted glass plate in the proper position for printing. The complete assembly is photographed on the thin sheet of grained zinc—aluminum in pre-war days—which is the final printing plate. The action of the light through the screen is exactly the same as in letterpress halftone making, so that the image is transferred to the surface of the plate in the shape of clusters of dots of varying size. The plate is then rolled up with a greasy ink that clings to these dots, and to which in turn, the printing ink adheres, being repelled from other portions of the plate which are wet with water before each impression.

The making of color plates for offset is equally as exacting as their production in any other process. The chief difference is that the areas on each plate in which another color would show in the printing, must be painted out so that no dots will be transmitted to the place in those areas.

It is noteworthy, that since offset impressions are, as the name implies, transferred from plate to paper via a "third party," the offset blanket cylinder, it is not necessary to "flop" the negatives.

The Photogravure Process

There are three types of photogravure reproduction of which only two are customarily used for books. The first is handprinted work from grained plates, the second, sheet-fed from plates clamped around the cylinder of a rotary press. Both are used frequently for book illustrations.

The copy may be any sort; paintings, drawings, photographs, or reproduction proofs of type. With the exception of fine type and lines, all will reproduce faithfully. A negative of the copy is made, carefully retouched, and a reversed positive or transparency printed, for further retouching, especially of areas where deep blacks are to appear.

The positives are then mounted in position according to the imposition layout, on a yellow, non-actinic paper, which is cut away to expose the parts which are to be printed.

Ozalid or blue prints are usually made at this stage for last minute checking, and frequently are provided before the copy is assembled in the layout.

Up to this point, the preparation is the same for all three methods of photogravure reproduction. In order to transfer the image to the plate, and then print it, it is necessary to reproduce the image in the form of tiny cavities to hold the ink necessary for the printing, as well as to provide some method of removing the excess ink and preventing the paper from touching those portions of the plate which are not to print.

In the hand-printing method, a resin dust is deposited on the plate and adhered to it by heat, thus forming the desired cavities. The more common practice, however, is to employ a screen exactly the reverse of that used in letterpress and offset plate-making, which causes myriads of tiny pockets to be formed. The light passes *through* the lines of the screen instead of *between* them as in the halftone screen. The walls of these cavities thus do not print as does the halftone dot.

This screen is imparted to the copy as follows: a sheet of carbon (actually gelatine) coated tissue, after sensitising, is exposed through the screen, and subsequently, through the positives on the yellow sheet referred to previously.

The tissue is then squeezed on to a copper plate, dried, and developed in hot water, which removes the backing paper and permits the exposed gelatine layer to remain on the copper. The unexposed gelatine, being soluble, is washed away. The result is a complete image of the subject in reverse, consisting of various thicknesses of gelatine; the thicker the gelatine, the higher the lights of the subject.

Areas of the plate which are not to print are painted out with asphaltum varnish, and the plate etched slowly with acids of varying strengths. The acid bites deeply into the shadow areas but leaves pure copper in the highlights, so that when the plate is inked, there is no ink in the highlights but a heavy thickness in the shadows.

Separate plates, as in each of the other printing processes, are made for each color, with color separation done in the

same manner. Sheet-fed gravure often permits effects to be gotten with 3 colors, which would require 4 or more in other processes.

Duplicate Printing Plates

11.

 \mathbf{B}_{i}^{OOK} printing ordinarily calls for use of duplicate plates, in the form of electrotypes and, less frequently, stereotypes, in order to make plates available for reprint purposes, release the considerable amount of type metal involved in book composition, and secure the best quality of impression throughout the run. Both are frequently used, also, to reduce the number of impressions needed to complete a book, duplicate sets of plates being made for each page. For example, suppose 50,000 copies are needed. If a set of duplicate plates is made and run on another press, press run time would be cut in half.

There are two main types of electros, those made from impressions molded in lead, and those from wax molds, of which the latter are the more common in this field. In each case there are several sub-divisions, based upon the purpose and the length of run to which they are to be subjected.

Basically, the making of an electro consists of molding an impression of the type page and/or cuts in wax or lead, and depositing thereon a surfacing of copper, which is later reinforced by lead. It is in the preparation of the form for molding that the success or failure of the finished job is largely determined.

Making Up for Molding

If the pages of the book are to be printed from electrotypes, special instructions must be given the composing room to use

DUPLICATE PRINTING PLATES

high spaces throughout, to take particular care in the spacing or justification of lines of type, to see that all cuts are typehigh, and that rules or decorative material are equally so.

In addition, there are other operations which should be followed to insure good molding. Thin rules should be protected on both sides by high spacing material, especially if they are not supported by adjacent type. Support should be given on both sides, if the face of the rule is less than the body width. Care must be taken to replace any battered or worn type, and to see that all cast composition—line or single-letter—is smooth and sharp. If fine screen cuts are to be molded, it is wise to have them removed from their wood bases and mounted on solid base material, or better yet, ''sweated''—soldered on the finished electro.

Halftones and linecuts alike should be etched deeply and sharply to get the best results in molding. Folios standing alone should have type-high spaces or inverted type placed next to them so that the thin lines will be protected in the molding.

After all corrections have been made and checked, the form to be electrotyped is placed in a sturdy chase (the metal frame which holds the type pages together) with type-high "bearers" or guards on all four sides which prevent the molding wax from flowing out of the area to be molded. Book forms usually contain from 4 to 8 pages.

Once locked "F-proofs," or foundry proofs, are taken for careful checking with the previous sheet, and alinement and all other details minutely examined, for, from this point on, corrections would be extremely difficult and costly to make.

The electrotyper, when he receives the completed form, molds an impression of it in a special type of wax—called a "case." The wax mold is then polished with graphite to make it conductive of electricity, before it is "built-up," e.g., hot wax is flowed on the low portions to make sure that they will not show on the printing plate. The case is graphited again and the edges "stopped out," so that the copper which is to be deposited will not adhere to them. Two final careful washings, one with pure water, another with iron filings and vitriol, follow. The latter gives the case a primary facing of copper, after which it is hung in the electrolytic bath, and particles of copper from the sheet copper anode, are deposited in the depression made in the wax by the molding.

After about two hours, the case is withdrawn from the tank and the copper shell is stripped from it, cleaned in lye, and laid face down on the table for "backing." Strips of tinfoil, which serve as a solder, are placed in the shell, melted, and hot backing lead poured in on top. After cooling, the plate is planed and sawed to the proper size. Ordinarily, for book work, plates are beveled on the sides and bottom, for attaching to the "patent base" (metal base slabs used on press beds) with hooks. Otherwise, they are blocked on wood.

Sometimes, tragedies occur, and a finished plate is found to contain an error. If the correction is a matter of a letter or two, the errors are punched out and a patch inserted. However, if the correction is large, it is safer to make a new plate rather than risk a difficult patch, because of the danger of the patch breaking loose on press and doing much more costly damage than would have been offset by the cost of a new plate.

For runs of 100,000 or more, ordinary copper surface electros are likely to show signs of wear, so that frequently such electros are faced with nickel for extra long life. Somewhat more expensive, but insuring even greater life, ,are nickel plates, which consist of a fairly heavy deposit of nickel on the surface, followed by another deposit of copper, with the final base of backing lead following.

"Tenaplate" is the term applied to electros molded in a special molding compound placed on an aluminum base, and coated with a high grade graphite. The principle of the compound is that instead of the molding material being displaced

by pressure as in the wax case, the tenaplate compound permits the impression to be formed by extrusion and elongation of the material. The case may also be handled at room temperature, instead of requiring warming as does the case wax.

Lead molds are invariably used for fine screen or process work so as to secure the sharpest definition and best register. It goes without saying that nickel surfacing will insure maintenance of results over long runs of such work.

The Stereotype

While the advertising and newspaper production fields are by far the greatest users of the stereotype mat, it has found some acceptance in the book field in recent years, especially so now, because of the scarcity of copper.

Essentially, it calls for the molding in a sheet of papier mache of an impression of the type form. The surface of the matrix is treated so that from it may be cast in hot lead either a type high or 11pt. thick solid leaden duplicate of the original form. The metal used is of a harder consistency than machine-set type metal, so that runs considerably greater than are possible with type can be obtained from such casts. Recently experiments have been made in plating the cast with copper and nickel and thereby gaining longer life. But even with these improvements, runs have not yet been made that will equal those turned out with electros. However, for short runs they have possibilities, provided certain precautions are taken in the composition, molding, and casting.

The composition must be made up of clean, well-cast type, with no hairlines or broken letters. Semi-high spaces should be used throughout. The mat material used must be a good quality "flong." The metal must be of correct temperature to ensure a good solid cast, free from low spots or damaged areas caused either by too hot or too cold metal. And of course the castingbox in which the mat is locked for the casting, must be accurate

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and so too, the bearers or steel bars which keep the metal within the confines of the mat and determine its thickness.

Stereotyping is not suited for fine screen work since in the molding and subsequent casting the dots have a tendency to spread.

The chief advantage of stereotypes is their very low original cost but this must be carefully compared with other considerations. They do have one more cost-saving factor, in that mats may be molded from type forms, and stored for possible reprint use, while the book is printed from the type itself. And of course a similar practice may be followed with electros.

12.

Presses and Presswork

B^{OOK} printing is accomplished generally by one of three methods—letterpress printing, photo-offset lithography and to a lesser, but increasing degree, sheet-fed gravure. In some instances the book may be produced by a combination of two, or even three of the methods, as each is particularly adaptable to certain types of work.

Because the folding and other subsequent manufacturing operations are done on the same machines and handled in the same manner regardless of the type of printing, certain elements of the printing operation are standardized for all three methods. Presses—whether letterpress, offset, or gravure— are manufactured in sizes designed to accommodate economically different page sizes, so that standard paper sheets can be used without wastage. Units in multiples of eight pages are the accepted basis, with 32 and 64 pages the number most commonly printed in one press "form." In all of the printing methods, each press run consists of the printing of a form, the pages of which are imposed properly for folding.

The first side of the sheet to be printed is called the "white." The reverse side printed is called the "backup." Usually each side of the sheet prints with a different form, so that if each form consists of 64 pages, the final printed sheet carries 128 different pages. This is what is called "sheetwise" printing. Sometimes, however, because of the way the number of pages may fall, it is necessary to print the same form on both sides of the sheet and cut it in half, thereby getting two sheets of the same set of pages. This is called "work and turn."

In addition to essential differences in actual printing methods, there is one general difference which is important to remember. It lies in the fact that in offset and gravure the making of the printing plate itself is really a part of the printing process. In letterpress, the printer works with type or plates delivered to him. In offset and gravure, the plate making and printing operations are much more closely knit together.

Letterpress

Letterpress printing was the first of the three to be perfected for modern mechanical, high volume results. While some letterpress book printing is done from actual type and photo-engraving plates of the illustrations, the general practice is to print from electrotypes. The electros are assembled into the printing forms, as many as are to be run in each form—usually 8, 16, 32, or 64. The electros are delivered to the press room "unmounted" —that is, they consist of metal molded only to the depth required for the actual printing surface so that they can be fastened on a metal base which is placed on the bed of the press.

The metal base is perforated with a honeycomb-like system of holes. The bottom edge of the electro is beveled, thus allowing a catch to be snapped over the bevel and through the perforation of the base to hold the electro securely.

The next step is the "makeready," which means exactly what it says—making ready for printing. A number of factors combine to necessitate a certain amount of adjustment in order to obtain a satisfactory final printing result. The weight and surface of the paper, the presence of halftones or other illustrations in the copy, minute variations in "type height" of the form, have to be taken care of in the make-ready, so that the printed result will be clear and legible, faithfully reproducing the originals.

The press cylinder which whirls the paper over the inked form to get the printing impression is swathed in layers of soft packing sheets and over these is fastened a hard sheet of tympan paper. A number of sheets are then run through the press. The pressman takes one of the printed sheets, going over it carefully inch by inch, marking with a pencil the printing imperfections. He then takes special tissue paper and cuts his "paper dolls." The latter are bits and strips of the tissue paper cut in irregular shapes to build up each spot of the printing surface which is hitting imperfectly. They are pasted on the printed sheet, which is then carefully wrapped around the press cylinder over the packing sheets, but under the tympan in perfect register position. The tympan is replaced and more sheets are run through the pless. The new sheets are inspected. If they are printing satisfactorily, the press starts its run. If not, more paper dolls have to be cut, or the packing sheets adjusted. The purpose of the packing sheets is to regulate the "sock" of the form on the paper. A hard-surfaced or coated paper prints with a light "kiss" impression, while the antiques or soft-surfaced papers need a harder sock.

The "double-ender," or perfecting press, has added considerable speed to book printing. Basically, it is two presses in one, united in the middle like Siamese twins. Two different forms are placed on the press beds, one at each end. There are two sets of ink rollers and two cylinders. The paper travels around one cylinder and is printed on one side, then is automatically turned

over and printed by the second form and cylinder on its reverse side. Thus a sheet run through a perfecting press will come out printed on both sides and ready to go to the bindery for folding; on a single cylinder the sheet would have to run through twice with two different forms to get the same results.

In addition to the standard sizes of cylinder press there is a small vertical press, used occasionally in book printing. In these presses, the form is run up and down against the cylinder instead of back and forth horizontally. They are speedy and efficient, but only accommodate small forms, sometimes necessary in book printing to take care of an odd number of pages.

Offset Lithography

The modern photo-offset press represents the development of lithographic reproduction so that it serves a high volume, commercial need. The old lithographic stone which produced such fine results by hand has been metamorphosed by photography, the use of a light zinc plate and a rubber blanket into a method of high speed mechanical printing. The principle of lithography —the fact that grease and water do not mix—is still the basis for the results produced by the photo-offset press. The difference is that the actual printing contact with the paper is made from the rubber blanket instead of from the zinc plate or the "stone," from which the name "offset" arises.

The zinc plate, prepared with "greased" ink adhering to the images to be printed, is fastened around the press cylinder. In making the press run, the printing plate revolves first against a water roller, then against the ink rollers, then against the roller with the rubber blanket. The greased ink image dots print on the rubber, the wet surface of the zinc does not. The paper meanwhile is fed through, makes contact with the printed rubber roller and comes out with an "offset" of the printing impression.

Sheet-Fed Gravure

Sheet-fed gravure printing is a comparative newcomer to the book field, but is rapidly gaining favor for certain types of work, particularly where emphasis is on the pictorial.

The gravure press printing plate is a thin sheet of copper fastened around a cylinder. The makeready for gravure, like that of letterpress, consists in adjusting pressure over portions of the impression cylinder to provide for heavier "sock" where the printing area requires more ink and lighter "sock" where there is little or no actual transference of the ink to the paper.

Collotype

There is one other printing method employed to a limited extent in book work. This is collotype, which belongs in the lithography classification, with some differences in detail of production. The "grease and water" principle is the same. In collotype, however, instead of the printing plate being etched, it is made ink-repellent by exposure after being coated with gelatin and the absorption of proportionate amounts of glycerine solution. Collotype is used almost exclusively for reproduction of pictorial copy. It is noted for its clarity in reproducing contrasting light and dark tones and clear highlights.

13. Imposition

I MPOSITION may be described simply as the arrangement of the type pages on the printing sheet. The arrangement necessarily must be planned so that when the printed sheets are sent through the folding machines they will emerge as book signatures with the pages in proper numerical sequence.

IMPOSITION

For standard book work there are a number of different impositions. The one to be used is determined first of all by the number of pages to be printed on the sheet and the number of pages in each book signature. The number of pages in each signature depends generally upon the weight and finish of the paper and the total number of pages in the book. Signatures of 16 and 32 pages are the most generally used in book work, although for certain jobs they may go up to 64 or down to 8. Lighter weight papers under 60 lbs. basic, usually will be imposed for 32-page signatures, or perhaps 64; the heavier stocks in 16's, or occasionally in 8's. The number of pages to the printed sheet depends, of course, on the relation of the page size to the sheet size.

Planning Imposition

It is extremely important that close collaboration be maintained between the binder and printer in planning imposition. The binder knows how the pages should be imposed in order to be handled efficiently on his folding machines, and should furnish the imposition with his folding machine guide markings. The printer should check the binder's imposition to see if it conflicts with any peculiarities of lockup, grain of the paper, press or sheet size. The printer also should check to see that the imposition is such that the grain of the paper runs parallel to the backbone of the book. Folding "cross-grain" on the machines creates difficulties that slow up the job and are apt to result in wrinkling or buckling in the folding, and subsequent production of an inferior book. The printer also should lock up his press forms so that the wasteage on the sheet is distributed evenly across, not all at one side to form a "tail." A tail is another trouble-maker on folding machines.

Another point to remember is that on standard impositions the press guide on the printing sheet becomes the binder's gripper edge, and the printer's gripper edge becomes the binder's guide.

In cases where the sheets are slit on press, the slit edge should be the binder's guide. So it can be seen that the two working hands of the binder and printer each should know what the other is doing.

The standard impositions cited here are for use on Dexter or Chambers folding machines. Clevelands operate differently and can be a great asset in the bindery when complicated, odd or unusual impositions are to be folded. Space, however, does not permit discussion here of the great variety of unusual impositions that can be brought to bear on jobs requiring such treatment.

Fundamental 16-Page

The fundamentals of imposition may be understood by starting with a 16-page signature to be folded from a printed sheet carrying 16 pages, 8 to a side. The arrangement of the 8 pages on the side of the sheet with page 1 on it, will be as follows, reading left to right, with four pages to each row: 5-12-9-8; 4-13-16-1. Turning the sheet over from left to right the arrangement of the 8 pages on the other side will be: 7-10-11-6; 2-15-14-3. The heads of the pages are toward each other.

By arranging the page numbers on a sheet of paper in those sequences it will be seen that 1 and 2 are directly back to back, as are 8 and 7, and so on with all 16 pages. The sheet is given three right angle folds. The first fold is made in half, parallel with the height of the type page, folding it so that page 1 is on the outside. The next is at right angles, still keeping page 1 on the outside. The third is at right angles, with 1 on the outside, which automatically throws 16 on the outside too. Thus you have a complete 16-page signature, the pages in proper numerical order. This imposition is usually called Right Angle 16.

With a 32-page sheet—16 to a side—the variety of impositions begins to increase, depending upon the number of pages desired for each signature. If it's to be a 32-page signature in

IMPOSITION

one section, 4 folds are necessary on the folding machine. If it's to be a 32-page signature in two 16-page sections, one inserted in the other, it is done with three folds, the sheet being cut in half in the machine after the first fold. Then the two halves are folded and automatically inserted by the machine. If it's to be two separate 16-page signatures, a cut is made but the two sections are separated by the machine instead of being inserted.

A different imposition is required for each of these. A practical test with a folded sheet of paper will quickly show why. With the single-section 32, the sheet is folded as one unit, to become a single signature. When the 32 consists of two inserted 16's, the last two folds are done in two units, and the pages must be imposed so that when the insert is made, the pages will be in proper numerical sequence. With the two separate 16's, the imposition must be planned so that the numerical sequence will be correct when the two signatures are placed one on top of the other, instead of one 16 inside the other.

32-Page Impositions

For the single section 32-page signature, the pages are arranged as follows. The side with page 1 on it, reading left to right: 9-24-17-16; 8-25-32-1; 5-28-29-4; 12-21-30-13. Turning the sheet left to right, the backup will be as follows: 15-18-23-10; 2-31-26-7; 3-20-27-6; 14-19-22-11. This imposition is usually called a Straight 32.

The 2-section, 32 page imposition is called Double 16 Insert. Following the same method as above the pages are arranged thus: 13-20-17-16; 12-21-24-9; 5-28-25-8; 4-29-32-1. The other side: 15-18-19-14; 10-23-22-11; 7-26-27-6; 2-31-30-3.

The two 16-page signatures imposition is called Double 16 Straight. Following the same method as above, the arrangement of the pages is: 21-28-25-24; 20-29-32-17; 5-12-9-8; 4-13-16-1. The other side: 23-26-27-22; 18-31-30-19; 7-10-11-6; 2-15-14-3. As the number of pages on each sheet increases, naturally the number of possible impositions increases also, depending upon the number of pages in the signatures, and how they are to be folded.

64-Page Impositions

On a 64-page sheet—32 to a side—for instance, one imposition will be required for 2 separate 32-page signatures. A different one is needed if the 32-page signature is to be inserted 16's. Weight of the paper and number of pages in the book may even call for a 64-page signature made up of inserted 32's, which requires still a different imposition. Or the weight or finish of the paper may be such that 16-page separate signatures are necessary. Still other impositions are necessary when two or more sets of the same pages are printed on the same side of the sheet—two-up, four-up, and so on.

There are a number of impositions designed to spread limited color impressions over as many sections of the book as possible. An ingenious production department may plan to take 16-page forms, for example, and have the printed sheet cut before folding into a 12 and a 4. This, and other variations can be worked out so that the limited color pages in a certain section of the finished book will fall consecutively, rather than alternately, as they would in a normal imposition.

Complicated impositions, however, are not normally encountered in standard book work and should be avoided whenever possible. The above descriptions of the fundamentals should be sufficient to afford a grounding in basic theories and practical applications.

Folding Machines

14.

I N BYGONE days when books were rather a luxury instead of a commonplace item of life, printed sheets were folded by hand, the workers frequently using a strip of polished hard bone as a "folder" to press the folds flat, and later to slit the sheets. Pages were usually imposed for a simple fold, and seldom exceeded 4, 8, or 16 pages to a signature.

Today, however, the simple bone folder has been converted into a giant, high speed mechanical folder which can take printed sheets with as many as 64 pages and fold them swiftly into complete signatures, sometimes as 16s or 32s following each other, or 16s inserted, etc., all depending upon the imposition of the pages when printed.

There are two major makes of book folding machines, Dexter and Chambers. In some instances, Cleveland job machines are used for special work. There are two basic principles of folding, one of which is the tape and knife method—the oldest type the other the loop or buckle type. The most common in book work is the first of the two.

As folders and runs of books became correspondingly larger, methods of automatic feeding already in use were adapted to the machines. Thus there are two types in use today. In one, the cross feeder, sheets are placed on a feeder table in reverse of the position in which the sheets are fed into the folder. The edges are fanned out around a large roller and, carried by tapes, are fed, one by one, into the folding mechanism, each sheet being carefully fed to the guides.

The second method is the pile feed, in which the sheets are stacked as they are to be fed into the machine, on a sort of ad-

justable hoist, which inches upward as the sheets are withdrawn from the pile by suction tips, by which each sheet is fed to the guides.

The earliest tape and knife models were introduced about 32 years ago. The basic principle is that the printed sheets are carried into the various sets of folding knives or blades by evenly spaced endless tapes, until they fetch up against an adjustable end stop or guide which positions them for the downward action of the knife. The knife, actuated by a cam mechanism, drives the sheet between the two knurled rollers which make the fold. Side register is obtained by a gripper device, not unlike that used on the press, which moves the sheet to correct position before the actual folding operation. The blades are usually equipped with needlelike points which hold the sheet in position for the folding.

The first fold being completed, the sheet is then carried on similar sets of tapes through other operations until the completely folded signature is delivered at the end.

The two major types of folds found in book work are parallel and right angle folds. The latter, as its name suggests, means that each fold made in the sheet is at right angles to its predecessor. In parallel folding each new fold is parallel to the preceding one.

The three most common types of machine in edition binding are the book and job folders, double 16's, and quadruple or "quad" folders. The former are used primarily in book work for small extra forms, and can handle sheet sizes ranging from $39'' \times 52''$ up to $48'' \times 71''$, and can produce four right angle folds. They may also be equipped with additional attachments. Most firms also operate a jobber for these extra forms, with a range of folds almost unlimited, since it is equipped with four right angle and two parallel sections. The maximum sheet size is $46'' \times 70''$.

The "Double 16"

The Double 16 folder offers two major alternatives—there are any number of variations possible. The sheets may be folded as two 16's, slit apart and inserted automatically one into the other by the machine, or delivered as two 16's following each other. These are known respectively as Double 16 Insert or Double 16 Straight (see the chapter on imposition for further details). By adding a 32p. attachment, it is possible to fold two 32's in the same manner. Sheet sizes: from 20"x30" to 53"x74".

The "Quad"

The quad folder is the "high production" machine for book work and was designed specifically for that purpose. It will produce four 16-page signatures, or two 32-page signatures from a single sheet, and is the fastest and most efficient machine for large edition work. In operation, the sheet is folded first with two parallel folds, then slit into four sections, and each section given a third fold at right angles to the first. The folded 16-page signatures may be delivered separately, or the two outside sections may be inserted to make two 32-page signatures. Its sheet range is from 22" x 30" to 42" x 56" in the major makes.

As the sheets are folded over and over, it is obvious that a certain amount of air will build up in the creases, which may cause buckles and wrinkles. Consequently, almost all types of folders are equipped with perforating or slitting devices which open up these folds and allow the air to escape, and prevent the aforementioned wrinkles, especially in heavy stock. Trimmers are also provided to trim all signatures to a uniform width.

The folded signatures are delivered into trough-shaped packers, so that bundles of them may be quickly withdrawn to feed the hopper boxes of the gathering machines. Or, they may be stacked in the signature bundling machines or compressors to extract the last iota of air, or tied up for storage.

Loop Folders

The loop folder is more commonly found in job and small publication work, but because of its speed and range of folds, it is frequently used as a subsidiary machine on which to run 4- and 8-page book forms, such as inserts, illustrations, etc.

The basic principle of this type of folder lies in the nest of 3 knurled rollers into which the sheet is fed, by a series of diagonal, closely spaced high speed feed rollers. The sheet is forced between the upper and lower plates of a folding plate or grid. As this takes place, the forward edge of the sheet strikes a deflector with an adjustable gauge, forcing the sheet to buckle. This loop or buckle in the sheet, when it makes contact with the knurling of the folding rollers, causes the sheet to be pulled through between them, thus completing the fold. By adjusting the deflector, it is possible to bypass any one or more of the numerous sets of folding plates with which these machines are equipped.

The high speeds at which modern folding machines operate match those of almost any other machine used in book production. Most folders will operate efficiently at speed from 3000 signatures per hour to as high as 25,000 in some special machines. The normal range, however, is between 2,500 and 4,000. The loop folders are the faster type.

Special attachments for folding thin papers, in the shape of mechanical points which drop into the right-angled slits made in the sheet at the time of printing, enable this work to be done in careful register corresponding with that made on the press. If such work is to be run exclusively, there are special "Bible Quad" machines available.

It requires a considerable degree of skill to operate folding machines, for knowledge of the effect of the grain of the sheet. the sort of fibers which make it up, and a sense of the limits in which certain papers may be folded is imperative.
GATHERING AND COLLATING

For this reason, the following table of the recommended maximum pages per section in various types of paper should be kept in mind throughout the planning of the book, and integrated with the equipment of the plant which is to produce it.

ANTIQUE: up to 60 lb., 32pp.; 60-80, 16; over 80, 8. BULKING: up to 65 lb., 32's; above 65, 16's. EF. or M.F. super, up to 60 lb., in 32's. COATED: never greater than 16's. BIBLE: up to 30lb., in 64's.

Due to the limitations imposed upon paper today, the tendency has been to use lightweight papers such as 40 and 45lb. Although more pages can be folded in one signature, such papers require more time in printing and folding, because of the trouble with wrinkles and slippage in thin sheets. The result is trouble on the machines, unless they are slowed down considerably.

15. Gathering and Collating

A FTER the signatures are folded they are jogged together and then pressed in order to flatten the folds and squeeze out the air between the pages. In the old days of hand binding this was done by merely "smashing" a number of signatures with a mallet along the folded edge. The efficiency of the folding machines have made this unnecessary, though on occasion smashing and power bundling machines are still used.

After the completed signatures have been tied in bundles between a board at each end, they are sent to the gathering department. Here they must first be pasted and reinforced before they can be assembled together in the "gathering" process.

Illustrations, inserts, maps, end leaves, etc., which are not bound within the book as separate and distinct signatures, must be pasted individually. Automatically-fed machines paste the end leaf papers to the first and last signatures. In books where special durability is desired, these signatures can be reinforced by a backing strip of muslin joint.

Single illustrations and leaves also can be machine-pasted onto the outsides of signatures. Those that go inside of a section, however, must be pasted by hand. Each insert leaf is handled separately. The sheets are fanned out on the table and a thin line of paste brushed on the edges. If the inserts are to appear within the signature, the pages must be cut open by hand, using a bone folder. While tedious and purely mechanical, many bindery girls have become very adept at this work. As yet no satisfactory machine has been devised to make this hand work unnecessary.

Hand and Automatic Gathering

Gathering is the operation of bringing together in proper sequence the various signatures that make up a book. Small editions are gathered by hand, the operator walking along a table, taking one section each from the succession of piles, a book being completed at the end of the table. Various methods of arranging the piles of signatures can be used. If both sides of a table are piled, a second book can be gathered on the return journey. Two piles can also be made, one behind the other, on one side of the table, in order to make unnecessary a complete encircling of the table by the operator to gather two books.

Circular rotary tables also have been developed. A series of operators sits around the moving table and gathers the sheets or signatures as they pass. The speed can be adjusted to equal that of the operators.

The great quantities needed in edition manufacture, however, cannot rely upon the slowness and dangers of errors inherent

GATHERING AND COLLATING

in most hand gathering methods. To meet the demand for speed, special gathering and collating machines have been developed. Piles of folded signatures are assembled in wooden bins which parallel the machine. The bindery operators, usually girls, take the signatures from the binds and place them in vertical baskets, the sides of which hold the signatures in place. The bottommost signature is separated from those above it by a suction system which bends the signature slightly without affecting those that are held in place above.

As the signature is bent, a long gripper arm reaches out, grasps the signature and pulls it out from the bottom of the pile and deposits it upon a conveying trough. The continuously moving trough now carries the signature and as it passes the next basket another gripper arm drops a signature upon it, the sections falling regularly in place as the conveyor moves. The last signature, with the end papers pasted on, is the first to be dropped in the moving trough. The book is thus gathered backwards, with the front signature being the last to be put in place.

The grippers which seize the signatures from the bottom of the piles are so regulated by micrometers as to "bite" only at the signature thickness size for which they are set. Should there be a thinner, thicker, or no signature at all in the pocket, the gripper is so adjusted that it automatically causes the entire machine to stop. A small flag-like arrow, placed above each gripper and basket set, which is called a "box," rises, thus calling the attention of the head gatherer to the cause of the stoppage. This enables him to go directly to the root of the trouble without having to examine each individual gripper to see what is wrong. As soon as the correction is made, the machine proceeds.

The number of "boxes" in the machine determines the number of signatures that can be handled. The smaller size gatherers, which handle 8, 10, or 14 signatures can be increased by adding extra boxes in sections of four or five. Gatherers in large edition

plants usually contain from 28 to 40 boxes, though of course not all are used on every job. A special device makes it possible to eliminate from use those boxes not necessary.

Running speeds range from 70 to 90 signatures a minute. Each is designed for a specific size of sheet. A 12-inch machine, for example, will accept a maximum size sheet $12'' \ge 10''$ and a minimum size sheet $6'' \ge 4\frac{1}{2}''$. The range of a 16-inch machine may operate from $6'' \ge 4\frac{1}{2}''$ to $16\frac{1}{2}'' \ge 11''$.

The standard type delivery is on a flat table, but special deliveries can be worked out to meet individual needs. Companion piece machines, designed for wire side-stitching are often attached. Telephone books, pocket size books, and certain catalogs are delivered to perfect binder attachments which cut off the back of the book by a disc knife, roughen and separate the sheets, and apply glue, crash, and cover, all in one operation, making the book complete and ready for trimming.

Collating

To ensure accuracy a final check as to the sequence, number and condition of signatures is necessary. This is called "collating." The operator grips the book firmly with the right hand, fanning out the sections. Holding the opposite corner lightly in the left hand, she releases the backs one at a time and, by glancing at the first page number of each signature, checks the proper sequence. Examining each book is not always possible because of the speed of the machine, so the operator usually takes and collates every fifth book or so as it is delivered. Should it be found that signatures are falling in the wrong sequence, the machine is stopped and all signatures before and after the one just collated are carefully examined.

Another method, which needs special care at the time of imposition and printing is the use of a small black mark on each sheet designed to appear on the edge of the outside fold. On

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each successive signature this mark is placed at a regular distance below the preceding one, forming a slanting line across the back of the book when gathered. Should any signatures be out of place, it becomes immediately apparent, since the diagonal line is broken.

16.

Sewing and Trimming

THE folded and gathered sections, as signatures, together with illustration inserts or outserts, title and end papers, pass from the collators to the sewing machines, another department which, without exception, is "manned" by girls or women. Automatic sewing is less than a hundred years old but has enormously increased the output of edition binderies. While it is a division of the binding of a book with which the publisher's manufacturing staff has little to do directly, there are manufacturing shortcuts which can be practiced by the publisher which will help him get his book through the sewing machines more rapidly. For it is in this department that the extra work caused by poor planning, such as too many small signatures, improper choice of stock, or bad impositions, can delay not only your book but everyone else's.

There are three major makes of sewing machines used in the bindery: Smyth, McCain, and Singer. Of these the first is used universally for the general run of trade books. Singer and McCain side-sewing are used primarily for text and reference books, in which strength is at a premium. However, Smyth sewing also is frequently used on these books, often in combination with tapes, the sections being sewed on the tapes as well as to each other.

Making the Stitches

In Smyth sewing, the sections are deposited on an arm which, after jogging, carries the signature in to the needles. These number up to 11, depending on the model machine, drive through the signature, pick up the thread, pull it through to make a long loop of thread, then hook it on to the next section, and so on through all the signatures of the book. The thread is fed from bobbins like any other sewing machine, but much larger.

Several books emerge in a solid block, and are cut apart either by a girl standing in back of the machine for that purpose, or on the most recent machines, by a special cut-off device, operated by a foot treadle.

There are various models of the Smyth machines in use, which will sew at speeds of from 50 to 85 sections a minute. One model is large enough to sew books two-up. Most are equipped with semi-automatic feed, the signatures being merely dropped on a saddle and pushed mechanically into the machine. The number of stitches and their length are adjustable to requirements.

Most machines are also equipped with automatic pasting devices so that a strip of paste may be deposited along all signatures or any particular ones to reinforce the sections or to hold smooth finish inserts in place.

The Singer machines in use are merely larger and heavier models of the familiar household sewing machine and operate in much the same fashion. However, for side sewing, a special drill is used to make the holes for the thread before it is stitched. The books emerge from the machine in a continuous series, and must each be cut one from the other. The books are usually smashed before sewing.

The McCain stitcher is another type of side sewing machine, developed to sew closer to the binding edge, for the purpose of obtaining greater ease of opening. It is also automatic feed.

Since the number of signatures which must be fed to the ma-

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chine determines to a large extent the speed with which the book can be sewn, an effort is indicated to keep the number to a reasonable minimum. Many books which are sewed in 16's, such as the 320p. novel chosen for purposes of discussion early in this series, may easily be sewn at least in 32's and in many instances, where thinner paper is used, in 64's. Thus, the above mentioned volume, if sewed in 32's, would amount to only 10 signatures, and in 64's, 5.

Another important point is that the more signatures in a book, the greater the amount of stitching in the back, which in turn increases the swell or thickness. Frequently this is so great the book must be squeezed in the jaws of a nipping machine before the book is "smashed."

Most trade books are tight sewn, because of the bulking paper used, which, when compressed under the smasher, would otherwise cause the sewing to loosen up too much. Loose sewing will soon cause a book to fall apart since there will be too much play in and on the threads, regardless of the glue used to hold the book together.

In some plants, the books are smashed before sewing to secure even tighter sewing. But a word of caution—if the book is sewn too tight, the operation of "rounding and backing" may cause the threads to burst. Each binder, however, is capable of determining the correct thread to use and the right degree of tightness to be observed.

Early in this book, it was pointed out how the addition of small forms made book production more expensive, if only in extra presswork. Such forms have their effect in sewing too, for they add to the difficulty of sewing all the signatures together, unless they are run as wrap-arounds or inserts around the first or last signatures. By the latter method they can be securely sewed in with the section, and the risk of having a small signature loosen up when sewed with thicker sections, is avoided.

Smashing

The sewed books, after cutting apart, are stacked for delivery to either or both of two machines, the "smasher" or the "nipper." The latter is chiefly used for squeezing along the sewed edges of books printed on hard finish papers, such as textbooks, to remove the swell caused by sewing. Most books of this nature do not require smashing, the nature of the paper being such that little would be gained by such compression.

On the antiques, however, the air must be driven out of the sheets and the swell taken out of the back, or else the book would not fit the covers made for it.

In Chapter 8 on specifications it was noted that the desired bulk of the finished book should be given the binder, so that he might know the pressure to be imposed on the book to bring it down to that size. The bulk, of course, has been determined from the tables of the number of pages of each weight of stock which will make a pile 1" thick.

The Sheridan smasher, which is as standard in the bindery as the Sheridan gatherer, consists of a gigantic press, the jaws of which move on steel columns to impart the pressure. The books are inserted a few at a time by a belt feed. The jaws close and maintain the pressure—300 tons—for a short period. The smashed books are then stacked for trimming.

The Trimmers

Ordinarily, books are trimmed in heavy, power-driven, specially designed book trimmers, which trim all three edges at once. In some plants, however, the trimming may be done on the several types and sizes of power paper cutters, thus requiring three separate operations.

The Seybold continuous trimmer is the one most frequently used for large volume work. To it books are fed backs down in a tapered feed trough, jogged to the head, and then gripped in

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a heavy clamp. Next they are moved into trim position by a four sided "table" which revolves with the books so as to trim the front of the books in one operation, then the head and tail. The cycle repeats, and thus a constant flow of trimmed books emerges at the machine's delivery end. Approximately 25 piles a minute, up to 6" thick, may be trimmed at maximum speed.

Another type is the Seybold 3-knife trimmer, which resembles the ordinary papercutter in many ways, but in which the books are fed manually to a set of three knives. When the lever is pulled to start the machine, the books are clamped, the head and tail trimmed, and then the front, in a matter of about three seconds. Other power cutters sometimes used for book work are the Sheridan, Smyth, Chandler & Price, Seybold, and others, but chiefly for smaller quantity production.

Rough trim books are those in which a slight trim is taken off the folds and the raw edge of the page, leaving a rough edge, intended to simulate deckle. Quad open front books are actually produced on the folder, the slitter attachment trimming off the waste, leaving it with a saw-tooth or web-press cut-off effect on the untrimmed edges.

17.

Forwarding

O UR typical book, as it comes from the knives of the book trimmers, were it now to be placed within its covers, would be a wobby, spineless affair, difficult to hold open and soon destined to fall apart. To hold the book firmly together at the binding edge, it must be coated with glue, reinforced with gauze and paper, and made ready for casing-in.

The first step in this chain is "gluing-off," or the coating of the binding edge with a thin coat of flexible glue which, when dried, will hold the book firmly together for the strenuous operation of shaping it so that the pages will open freely and turn without difficulty.

In the majority of edition binderies, the books are first "glued up" by hand, the worker deftly applying a thin coat of glue to a stack of books in a few strokes. However, in some of the larger, more mechanized plants, this operation is done by a Pleger book back gluer or Sieb gluing machine, girls feeding the books back down to a roller device which spreads the glue on the backs. In some instances, where high speed production is at a premium, the glued books are passed slowly through an oven to dry, before the next operation.

Once again, the systems followed in various plants differ. In some, the edge treatment is applied at this point—in others it is applied after the books have been rounded and backed, and lined up.

Most trade books, such as our hypothetical novel, seldom receive more than a "top stain" of aniline dye, usually applied by an air gun, but not infrequently by a sponge or brush, an entire stack of books being so stained either way.

Rounding and Backing

The glue and stain dry, our novel is now ready for shaping. Such books are usually "rounded and backed," as this operation is termed, on either of two makes of machines, Sheridan or Smyth. Both operate on modifications of the endless chain principle, but their appearance and mechanics differ widely.

In the Sheridan machine, which frequently combines the rounding, backing, and lining-up operations, the books are fed *backs down* by groups into a hopper at the center at one side of the long low oval-shaped machine. Each book is then automatically placed between the jaws of one of a long series of clamps, and starts on its way around the machine, eventually to emerge at a point beside that at which it entered. Each of

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the clamps is set to the bulk wanted. One large bindery operates a complete machine of this type which will handle two books.

The books first enter a "nipping" station where the backs are compressed to uniform thickness which is necessary in order to produce uniform "joints." After "nipping" they are accurately registered and levelled by a pusher device in the clamps which carry them to the rounding station. Then they pass between two knurled steel rollers which partially revolve round the binding edge of the book, thereby imparting to the foredge its familiar concave shape. The books then pass into the jaws of one set of backing "irons" which clamp the book momentarily, allowing the rounded portion to flare outward on each side, thus creating the crease or "joint" along each edge, into which fits the corresponding joint of the case. A second set of irons completes the operation. It is this crease, or hinge, on which the pages of the book "swing" when in use. Since the final shape of the book depends on this operation, the joint should be deep, sharp, and of equal depth.

Lining-Up and Headbanding

The next stage is the reinforcement of the book with the gauze and paper strips which securely hold the signatures together and in shape, and help hang the book in the cover. This step is labeled "lining up." The application of the bits of cloth with colored edges to the head or tail of the "spine" of the book for reinforcement or decoration, is termed "headbanding."

On the combination Sheridan machine, after the rounding and backing operation, the books continue in their respective clamps, passing above a glue roller, which, operating at right angles to the direction and length of the book, deposits a film of glue across the back. Moving on, the backs next receive a strip or two of the gauze (with another coat of glue between each) which is cut and deposited from rolls of the material 80

which feed in from spools attached to the machine. These are rubbed down securely, another coat of glue is applied and then the book receives its final reinforcement, a strip of tough lining paper, such as kraft or similar material, the exact width and length of the back.

If headbands are wanted, these are fed from rolls of the material, which may be ordinary bookcloth, linen, cotton, or silk, and from which small squares the right width are automatically cut off and deposited on the lining paper before the book emerges from the machine. Bands may be used at both head and tail, or in either spot alone.

The cloth reinforcement is known variously as "super" or "crash" and is a stiff gauze or muslin, which ordinarily extends from $\frac{1}{2}$ to 1" over each side of the book, and usually the full length of the book, although many binders prefer that it be held to the distance between the "turn-ins" (See Chapter 7.) of the cover. It is this cloth hinge that forms part of the major connecting link between the cover and body of the book, and it is held firmly in place by the end sheet which is pasted down over it to the cover.

For most textbooks or heavy books, two crashes are employed, though in many cases, a single piece of "legal crash" is used. This stronger material shows a series of equidistant stripes in which stronger threads appear, and is placed so these are at right angles to the bulk of the book. Sometimes one crash and two paper linings are used instead.

There are essential differences in operation and appearance, however, in the Smyth machines used to perform the same operations. The Smyth rounder and backer is a smaller, more compact machine, into which the books are fed singly, *backs up*, passing through the machine in a straight line, traveling only a short distance. Each book is automatically carried to a pair of rounding rolls, in which it is first leveled, then rounded as it is held in position. The book is then seized by a set of jaws which move it under the backing "iron," a heavy roller which rapidly rotates over the book, shaping the back. Two toggleaction clamps apply the pressure required to hold the book, while the joint is formed by the backing iron. The book then emerges at the opposite end of the machine in readiness for the next operation.

The Smyth triple lining and headbanding machine is about a man's height and is very short and compact. The books travel side by side through the machine, instead of end to end, on a conveyor belt system, which is not unlike a tank tread in appearance. Fed *backs down* into a trough, they pass over a glue wheel which deposits the glue from end to end of the book instead of across it. The books then move to the crash station, the material being fed to a carrier on which the correct width is cut off and deposited and held firmly by air suction, then placed on the back of the book.

Either one or two crashes can be applied, the exact width of the book, or one only may be allowed to extend beyond the joint on each side. Also, both may be staggered so that each one forms the overlap on one side, thus giving a single thickness in the joint but double on the back.

The paper lining is applied in much the same manner as the crash, but in the event head bands are used, these are first positioned on the lining paper, and the combination applied to the book. Before leaving the machine, the linings are rubbed down by a set of rubber rollers. The finished book then drops from its conveyor station onto a platform of endless chains which carry the book out of the machine for stacking.

Much of the future flexibility of the book depends upon the formulas of the glues used in these operations. "Flexible" adhesives, manufactured so that they will remain soft enough not to crack during the life of the book, but at the same time will be non-fluid, are of two general origins. The animal-base flexible glues are specially prepared with the addition of glycerine and

other ingredients to the raw material. The synthetic resin adhesives—comparative newcomers to the field—are syntheticallymade products.

18.

Casemaking

The production schedule of the modern book is now approaching the point of union between the folded, gathered, and sewed sheets, and the cover, or "case." In the making of the latter is to be found one of the highest developments of the mechanized production of books.

There are two major types of casemakers in use, the Sheridan and Smyth machines. Since each operates on a considerably different principle, it is important to remember their differences, as they have an effect on the design and production of the book.

The Sheridan Casemaker

The Sheridan machine is fed from a complete roll of cloth or paper, whereas the Smyth is fed from a stack of sheets of cloth or paper cut to size. Because of this difference, it is possible to use cloth pre-printed in an over-all design on the Sheridan, direct from the roll, regardless of how the design may fall upon the finished cover. For the Smyth machine, however, the cloth may be printed only after the roll has been sheeted to the correct cover size. On the othr hand, the Smyth machine is frequently used for half- and quarter-bound styles, i.e., cloth backstrip and paper or cloth sides of another color, or vice versa.

Since the cloth is supplied in rolls, it must be slit and rewound to the proper width for use in either machine. This is done on slitting machines made by each manufacturer for the purpose, which, by means of revolving cutting wheels, slice the cloth to

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the desired measurements. In the Sheridan slitter the cloth to be used is re-wound on a special spool, which is set in place at the feeding end of the Sheridan casemaker. The Smyth slitter, after sheeting the cloth to the overall size of the case, with allowance made for all turn-ins and joints, and the corners trimmed for the tuck on the covers, rewinds the excess yardage.

There are three major sizes of Sheridan machines, which feed from rolls of cloth 14", 17", and 25" wide respectively, thereby controlling the size of the cases that may be produced on each machine. Operating speeds allow for a rate of from 1500 to 2400 cases per hour.

The spools of cloth are clamped in place at one end of the machine, and the cloth web is fed upward, then horizontally, through a set of gluing rollers, towards the opposite end of the machine, from which the finished cases are delivered. Then a thin coat of casemaking glue is applied to the continuous web of cloth.

Boards, cut to the correct size on a rotary or shear type board cutting machine, are fed from a hopper suspended over the web, and positioned correctly on the cloth. Then, from a roll of backlining paper suspended above the cloth, the correct width and length is cut off, and, held by a pneumatic device until it is released, is also deposited in position, and pressed down by a revolving wheel.

The boards and lining may be placed either at right angles or parallel to the cloth web, depending upon the type of machine and size of case desired.

A gripper device is next in line and combines with it a corner cutting attachment which chops out a small triangle from each edge of the cloth at the point where the cases are to be cut apart and the corners turned in. This adjustable traveling device pulls each case forward, then travels back again to seize the next one, thus providing a steady tension on the material, and transmitting the cases through their several processes.

After it leaves the corner cutter knives, the case passes between a set of channel-like brass strips or folding guides, set to the exact size of the case, which turn the cloth edges upward. A small steel roller is pushed forward from each side to turn down head and tail edges and adhere them securely to the boards. The web then moves under a rising and falling knife blade which cuts the individual cases apart, after which the remaining or side edges are turned-in in similar fashion. The completed case then passes through a set of smoothing rollers, before being ejected into the receiving hopper by a belt delivery.

The Smyth Casemaker

Smyth casemakers are either automatic or handfed, as circumstances require. Frequently they are used in pairs for half-bound or quarter-bound work, thereby getting complete production of finished cases without resetting a machine already used for backstrips, to put on the cover papers, or cloth.

The automatic feeder, by means of suction cups, feeds the sheet of cloth or paper, already cut to size, to a set of tiny "grippers" which hold the material securely on a revolving cylinder. During its revolution the glue is applied from the glue box and rolls located directly beneath the cylinder, and in front of the operator. After this step, the cloth is carried forward to the station at which the boards are placed in position.

Both the boards and the back lining are fed from hoppers located directly across the machine from the cloth feed cylinder. They are fed forward from the bottom of the stack, after which a "picker" mechanism, again employing suction cups, picks them up, makes a half turn to the right, and places them upon the glued material. Next, two turn-in bars move forward to turn-in the top and tail edges, after which the case descends to a second turn-in station, where the action is repeated with the sides.

The cover is then run through pressing rollers, which smooth

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the case thoroughly and remove any excess moisture, after which the finished cases discharge into a hopper.

The range of cases which may be produced on the Smyth machines approximates $3\frac{3}{4}$ " x $5\frac{1}{2}$ " to 16" x 22", and they operate at speeds of from 700 to 1200 cases per hour.

Pre-printed offset cloths may be used on the Smyth machine but only after the cloth has been cut to the size of the case, and then printed. On the Sheridan, it takes some time and spoilage to adjust the feed so that the entire design—if it is not an overall type—appears in the correct position on each case.

It should be kept in mind that if any particular *embossing* in an overall pattern of the cloth is desired, and the job is to be run on the Sheridan machine, the embossing must be done on the completed case, since there is no method at present in which the embossing may be done on the roll, except at the cloth mill. Most special grains, etc., are applied in the stamping operation, following the making of the case.

19. Cover Finishing

M OST trade book covers are finished by stamping in binders' ink, genuine or imitation flat or roll gold leaf, or pigment color rolls, from brass dies, electros, Linotype or Ludlow slugs, or binders' brass type. Since the precautions and methods of making the stamping dies or substitutes, were fully described in Chapter 8, this section will deal with the materials and machines used to finish the covers.

Originally, genuine gold leaf, beaten out laboriously into sheets, by hand, was the only stamping material in use. Later, printing ink was used, and subsequently special binders' stamping inks were developed. The past few years, however, have

seen the introduction of both flat and roll imitation and genuine gold leaf, and pigment color rolls.

Imitation gold leaf is made from a bronze powder combined with a vehicle and spread out into a thin film upon tissue, glassine, or cellophane "carriers," with a special sizing to insure its adherence to leather or imitation leather. Eventually a similar technique was applied to the production of genuine gold leaf in roll form, and not many years ago, pigment color rolls were developed as an improvement over inks.

Stamping inks include special pyroxylin inks used for stamping cloths treated with the same material. Ordinary ink is not successful on such work, peeling and discoloring from the effect of the chemical. A large amount of pigment and adhesion is necessary in stamping inks.

Stamping Presses

There are several makes and types of machines used in stamping and embossing covers. Chandler & Price Automatic, Brandtjen & Kluge, and Colt's Armory Platen presses are equipped with special attachments for the feeding of all types of leaf, as well as for the printing of the covers in specially made binders' ink. These presses used for inking and stamping are merely adaptations of typical job printing platen presses, strengthened to withstand the heavy impression required to stamp the cover. The covers are stacked in the feeder or on the feeding table, and stamped in much the same manner as a regular printing job.

Built specially for the purpose of stamping, however, are the massive Sheridan, Seybold, and Standard stamping presses, which are equipped with heated and adjustable platens. Somewhat similar, but with even greater power, are the heavy embossing presses. Seybold and Sheridan also build upright inkers.

In practically all operating principles, these presses are considerably alike. In each, the die, whether it be $\frac{1}{4}$ or $\frac{3}{8}$ thick

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—these measurements are in use in New York and Chicago respectively—is glued fast to a steel block and held in place by clamps on the heated upper platen. The temperature of the platen will vary from 200° to 350° depending upon the area to be stamped and the type of cloth.

The cases may be fed either by hand or automatically on to the lower platen, upon which are arranged adjustable slotted guides so that the stamping may be accurately registered in the correct position.

In the automatic feed presses, they are fed from the bottom of the feed hopper, forward to the stamping platens, and ejected into another hopper in the rear.

The distance which the web of leaf is moved forward at each impression, termed the "pull," is also adjustable, so that small or large covers may be handled. The operator must adjust this properly as well as engage in "makeready" on the dies.

Most presses operate on a toggle principle, which forces the two platens together under intense pressure—as much as 250 tons—and holds it for a brief period, then releases the jaws, after which the cover is withdrawn.

Either ink or leaf may be stamped on virtually any kind of cloth, but there are certain combinations which don't work well together, and for which certain precautions should be taken. Pyroxylin-treated cloths, for example, may not be stamped with any degree of success except with special pyroxylin inks, as noted earlier.

Patterned or grained cloth cannot be successfully ink stamped without first being "blanked" (stamped in blank) to flatten out the embossed pattern or grain, such as leatherette, silk pattern, etc. It is not usually necessary on leaf or color roll stamping because of the heavier impression and the heat.

It is not advisable to stamp one pigment color over another as the second impression does not adhere well to the first. Nor does ink stamping hold well on previously applied gold,

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although a reversal of the procedure will prove satisfactory. If reverse effects are wanted, for example, in a panel, it is better to have the dies made so that the second impression will not fall upon cloth already stamped in gold or color. Blanking is frequently used for borders, panels, and for panels in which a label is to be pasted.

Ordinarily, ink stamped covers, especially if a light ink is used, will need from one to three impressions to secure solid coverage, especially of large areas, although usually one impression or "hit" will do the trick. Pigment stamping will insure the best results on coarse cloths or on heavy panels.

It is advisable to submit cloth samples and the color desired to your binder well in advance, so that he may try them out to see what results will be obtained. In the case of inks, this is particularly important, so that the right shade of ink may be mixed for the job and tested on the material to see if there is any change of color caused by the combination.

Some designs may call for embossing, either blank or in color, in which case, the dies are made exactly the reverse of stamping dies, the press used a much heavier one, and the impression held considerably longer. These same presses are used for graining imitation leather. White or metallic papers may be embossed on the cover also.

The stamping or inking of covers is not a process which may be hurried, if good results are wanted. The operation of the machines requires a considerable degree of experience and patience to experiment with temperature, impression, etc., to secure the best results. Lack of cooperation or planning in the production department may lead to an unexpected cost increase in the manufacturing price, because an extra operation was needed in stamping. Dies may be so large that it is necessary for the operator to strip the cover from them; electros may be so soft that they melt or spread under the heat required to secure good adhesion. Fine lines in type or drawings may spread in the

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dies or electros, resulting in a smudgy appearance; errors in judgment or bulk may result in oversize or undersize spine dies. In many cases, gold stamped covers have to be rubbed off by hand to remove bits of gold flake that have adhered to the cloth in narrow spaces where they are not wanted.

Other Methods

If sizeable areas are to be in color on the cover, the use of silk-screen printed covers should be considered, if the cost is to be cut down. In this process, which is virtually always done outside the book manufacturing plant, separate stencils are cut for each design or color and adhered to a silk screen ground. Special paints or inks are then squeegeed through the interstices of the material on to the cover, to form the design.

The handling of offset printed cloth has been dealt with in the preceding chapter, but a word is needed about bookbinding papers, now being used so frequently. Practically all the same rules and precautions apply—grained papers must be flattened if they are very heavy and pyroxylin inks used on treated papers. Certain types of papers, when hot stamped, will show a change of color in the area, so it is again wise to let your binder experiment with the paper and ink or leaf to see what the final results will be.

20. Casing-In

Our hypothetical novel is at long last nearing its final stage, the point where it is transformed into a complete book, ready for its jacket and subsequent shipment to the book store. The "casing-in" operation is the final step in the physical transformation from ms. to book, and is a term which owes its very

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origin to the machine production of books. It is a step which is performed by machine in virtually all binderies because of the speed and accuracy with which the operation can be performed. Were it not so done, all the mechanization preceding this step would amount to nothing for the books would soon jam up in the covering bottleneck.

Back in the chapter on gathering and collating (Chapter 16), it was explained how the end sheets were pasted on the first and last sections in preparation for the union between cover and book. These end leaf signatures, made from specially sturdy paper, have a big part to play in the completed work. For it is upon them that the strength of that union depends. They must be able to absorb the paste with which they are daubed in the casing-in process without letting it soak through, and resist constant folding in opening and closing the book. They are the sole link between cover and book, except in the instance of textbooks when reinforcements are provided in many instances.

The Smyth Casing-In Machine

The recognized machine in this division of book production is the Smyth casing-in machine, which is built to form the cover automatically, apply it to the book, press the two together, and deliver the finished product, free from spots, stains or marks, ready for "building in," or pressing in the hydraulic book presses.

One of the earlier types of this machine is the famous Smyth "windmill machine," which was the first to produce high speed casing-in. Subsequently modified and improved, its production rate became even higher, until it now is recognized as one of the "musts" of every large plant.

The "windmill," so-called because of the resemblance of its group of three rotating fans to the arms of a mill, is fed by the operator from a stack of the rounded and backed and lined-up books. Essentially it consists of the fans or plates upon which

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the coverless book is hung with the fan "splitting" the book; a hopper feed for the cases; case forming rolls; paste boxes from which the paste is applied to the end sheets; pressing rolls and delivery. The operator feeds a book onto each fan, back up, in rotation, a book coming off for each one going on. The fans revolve until the book is positioned in readiness for the cover. Then the blade descends with the book. As it does so, paste rollers apply the paste, and the cover, fed from the bottom of a hopper feed, is deposited on the book. The cover already has passed through electrically heated case formers which shape the hinges to form the body of the book. The covered and completed book is once again deposited on the fan blade and swung out for manual removal.

However, a newer and faster machine, which operates upon a somewhat different principle, is now in use in many of the largest plants. This machine will case-in from 10,000 to 12,000 books a day, almost double the production of the older machines. This machine, semi-automatic in operation, does not reverse the motion of the book in passage through the machine as did its predecessor. The books are fed into a trough to a splitting device which is more positive than the hand feeding process. The books then move from the splitter to a saddle which heads them up, and passes them on to the fan blades, of which there are six, in two sets of three. These are attached to an endless chain, which, operating intermittently, causes the books to come up through the saddle and push the book through the paste rolls. Here there is a slight pause to allow the roll to come into position at the joint and apply an extra quantity of paste at the joints and super, where it is needed.

You will recall from the chapter on lining-up, that a small sctrip of super about $\frac{1}{2}$ " to 1" wide is always allowed to protrude over each side of the back. It is this strip which, when pasted down under the end sheets, helps anchor book to cover.

The book remains stationary until the cover has been fed from

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the case magazine through a set of electrically heated "formers" which crease it at just the right spot for the joints. Furthermore, it rounds the back. (In the event flat backs are wanted, special formers are provided for both machines.) The book and cover are now pressed together between rolls, and emerge from the chain cycle, ready for delivery.

Before this, however, they are snatched from the fan blade by a set of jaws equipped with strips which fit into the joints, and set them, before discharging the book, back down, into the delivery chute.

The fact that the casing-in operation is ordinarily automatic, however, does not mean that *any* book, large or small, may be cased-in on this machine. There are certain limitations in size and speed. For example, while the older model will handle books from $\frac{1}{8}$ " to 3" in thickness, and from 4" x 7" to 14" x 22" in dimension, speed is sacrificed considerably. The range of the newer machine runs only to $1\frac{5}{8}$ " and these size limits: $3\frac{3}{8}$ " to $9\frac{3}{8}$ " head to tail; $2\frac{1}{2}$ " to $7\frac{1}{2}$ " front to back. In no case may the thickness and width combined exceed $3\frac{3}{4}$ " x $5\frac{1}{2}$ " to $10\frac{3}{8}$ " x $17\frac{1}{4}$ ". A special large range model, however, attains these sizes: $3\frac{3}{8}$ " te 10" head to tail; $3\frac{1}{4}$ " to 10" front to back.

It should be obvious why such close attention is paid to the necessity of determining the correct bulk of the book-to-be. For if this should not be correct, the result would be a badly-fitting case, with resulting strain on binding, sewing—in fact, on the entire book. To correct such a condition at any time would be expensive and time consuming. This emphasizes the need of working with your bindery all the way through the job to make sure that books and cases can be united in "perfect bliss" at the end of the production line.

Naturally, the finished book, when it comes from the casingin machine, is still a "green" book. If it were to be shipped immediately, there is every possibility that its covers would warp until a worm's-eye view would remind one of a veteran cowboy's

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legs. To overcome this problem, the finished books ordinarily are immediately stacked in book presses between special type boards and kept under heavy pressure. The time assigned should be at least 24 hours, but is frequently less. Even books which have been forced to be left out of press for a short space of time may be restored to their correct shape in these presses.

The books are stocked in layers on special dollies, with iron or brassbound pressboards which fit into the joints of each book between layers. The layers are frequently four or more feet high, and the assembly is compressed in a hydraulic press, and the thumb screws on the long side clamp turned down tight to hold the pressure. After the books are dry, the presses are opened, and the books are jacketed, wrapped, and prepared for . shipment.

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Inspection and Shipping

WHEN the completed books have sufficiently dried within the confines of the building-in presses, the presses are opened and the books forwarded to the inspection department where they are carefully examined and checked for imperfections before being jacketed, packed, and shipped. Here again, it's "ladies day," for women and girls are invariably chosen for this task.

Despite the fact that the books were "collated"—a term often and incorrectly used interchangeably with "gathered"—after the signatures had been gathered in their proper order, there is still plenty of room for imperfect books to get by. A competent inspector will have a dozen things to look for, but most of these faults subsequently can be repaired so that the volume is not a complete loss. Nevertheless there are many instances in which

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the successive operations occurring after gathering may have misfired in some way on a few books, and resulted in some so badly damaged or out of shape that they cannot be salvaged.

Some of the things a good inspector will be on the watch for, as she flips through the covers and pages of each book, are: stuck endpapers, bad coloring, "starts," bad or unstamped covers, books cased-in upside down, inverted signatures, and bad printing. Many of these faults, of course, are caught in the earlier inspection, but this final check is made to be certain that the absolute minimum gets through.

The causes: The end papers may have been stuck by an oversupply of paste oozing onto them from the casing-in operation. The coloring may be poor as a result of an uneven spraying of the dye on the edges by the workman engaged in that operation. A book may be "hung in" its covers upside down as a result of those quirks of reversal of motion that happen to the best of us—it can just as easily happen to the girl or man feeding the casing-in machine. "Starts" are signatures that have been lopped off a bit on one edge or another, caused by faulty jogging before the books are trimmed in the big trimmers. Sometimes corners are tucked in accidentally in folding or the other operations, and this too is a cause for rejection.

Several chapters earlier, we discussed the production of the jacket, which is now to be combined with its book. This operation is done completely by hand. Girls obtain stacks of the already-printed-and-trimmed jackets from roomy storage bins, and with deft fingers, encase each book in its jacket. The jacketed books are then forwarded to the shipping room for whatever type of shipment may be required, or for storage.

It is in the jacketing operation that error in computing the bulk or overall size of the book will turn up, too, and embarrass everyone. If the backbone design has been made too wide, the extreme letters in the title which should show, will slip around into the joints. If too narrow, the skimpiness will be all too evident. That is why watchful production heads provide room in the design of the jacket for trimming such plates if need be, in order to compensate for the loss of bulk in a reprint on lighter stock, or for other changes in format occasioned by a re-issue.

If large bulk shipments are to be sent to the publisher, the books are stacked several tiers high on platforms, wrapped and banded, then shipped. For single, or two-or three-copy shipments from the manufacturer, the books are sent to the shipping room, cartoned and addressed as indicated.

Now, at long last, our hypothetical novel, with its 350 pp. of pica typewriter ms., has finally been converted into a finished book, via: copy estimating and preparation; paper selection and ordering; composition, proofreading; choice of cover material and method of embellishment; production of illustrations and jackets; printing, folding, gathering, sewing, lining up, backing, case-making, and casing-in. It should be emphasized again that careful planning and cooperation with your manufacturing supply services all the way down the line, will enable you to avoid the major pitfalls that have been mentioned in passing. Things will go wrong occasionally, it is true, but they are not wholly irreparable. At any rate, there are many guideposts along the way, in the form of helpful books, and experienced men and women who know the ropes and will be glad to help. In the various preceding chapters, the names of many of these books have been mentioned. To these should be added the sage counsels of Will Ransom which have appeared in the pages of BOOKBINDING & BOOK PRODUCTION regularly each month for years.

The type in which this book is set is Intertype Garamond, 10 point with 2 point leading. Display is Monotype Garamont. It is printed on Champion Wedgwood offset, substance 60.



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